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SITE SURVEY
OF
THE NAVAL STATION NORFOLK
PROPOSED DEGAUSSING RANGE
AND
DEPERMING SLIPS

FPO-1-85(9)

February 1985



Ocean Engineering

CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON NAVY YARD
WASHINGTON, DC 20374

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by

Sandra C. Vickstrom

David A. Raecke, Director Construction Division

Ocean Engineering and Construction Project Office Chesapeake Division, Naval Facilities Engineering Command Washington, DC 20374-2121

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Norfolk Harbor. The Entrance Reach Channel of Norfolk Harbor has been selected as the site for a future degaussing range to be operated by the Naval Station Norfolk Magnetic Silencing Facility (MSF). The purpose of the survey was to provide geotechnical information for the design of the degaussing range and the associated platform. Additionally, a probe of the cable route from the platform location to the shore ranging facility was required. The platform location to the shore ranging facility was required. The survey also included a bottom probe of the MSF Deperming Garden which is located on the southwest bank of the Norfolk Harbor Lambert Bend Channel. This information was requested for the purpose of planning the installation of new hardware and cables in the deperming slips.

ACKNOWLEDGEMENTS

CHESNAVFACENGCOM commends the efforts of all organizations involved with the Norfolk Harbor Survey. Our appreciation goes to Mr. C. Stewart, Director of MSF, Norfolk Naval Station and his colleagues for their assistance to CHESDIV while on site. We thank Mr. Hank Lingg of NCEL for operating the vibracorer and for his assistance in working with UCT-1 during the coring phase of the survey. Also, we extend our thanks to Chief J. Aylsworth and the detachment from UCT-1 for their support and their professionalism which aided in the efficient execution of this survey.

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SECTION I

INTRODUCTION

1.1 Objective

This report describes the purpose, execution, and findings of the geotechnical and geophysical survey performed by The Ocean Engineering and Construction Project Office of Chesapeake Division, Naval Facilities Engineering Command, (CHESNAVFACENGCOM) in the Entrance Reach and Lambert Bend waterways of Norfolk Harbor. The Entrance Reach Channel of Norfolk Harbor has been selected as the site for a future degaussing range to be operated by the Naval Station Norfolk Magnetic Silencing Facility (MSF). The purpose of the survey was to provide geotechnical information for the design of the degaussing range and the associated Additionally, a probe of the cable route from the platform location to the shore ranging facility was required. survey also included a bottom probe of the MSF Deperming Garden which is located on the southwest bank of the Norfolk Harbor Lambert Bend Channel. This information was requested for the purpose of planning the installation of new hardware and cables in the deperming slips. Konserver Varance of Decree in the deperming slips.

1.2 Project Background

The Ocean Engineering and Construction Project Office of CHESNAVFACENGEOM has program responsibilities to design and install the in-water facilities for all Magnetic Silencing Facilities. This survey represents the initial investigation of the environmental conditions which the degaussing range facility design must accommodate.

The existing degaussing facility is located west of Sewells Point in the northern most section of the Norfolk Harbor Reach Channel. The degaussing range is being relocated to deeper water and in a straight channel to overcome the problem of servicing large naval vessels in an area of limited maneuverability and negligible clearance. The selection of a new facility location required a site survey to determine the design requirements imposed by the immediate environment such as bottom soil density/composition and typical channel currents. Given the existing program schedule, budget, etc., the deperming garden was included in the survey to provide information to support future hardware replacement.

1.3 Tasking

Naval Sea Systems Command (NAVSEA) Code 56Z14 tasked CHESNAVFACENGCOM to provide engineering and management services necessary to design and install facilities for new and updated degaussing equipment. CHESNAVFACENGCOM tasked the following organizations to provide the specified assistance:

Naval Civil Engineering Laboratory (NCEL) - Provided vibracorer with expendables and operator.

CHESNAVFACENGCOM Ocean Construction Equipment Inventory (OCEI) - Provided equipment as required from available inventory at St. Juliens Creek, Portsmouth, Va.

Underwater Construction Team One (UCT-1) - Provided diving support; equipment operation and deck force, and served as liaison with the US Coast Guard and NAVSTA Norfolk, Va.

Value Service Engineering (VSE) - Provided support by contracting Law Engineering Testing Company (LETC) to perform the required soils analysis. LETC provided transportation and analysis of four core samples, documentation and report of findings.

1.4 Cost Data

1.	VSE (Law Engineer	ing	included)	\$ 2	23,786
2.	NCEL (Vibracorer	and	Operator)	\$	3,979
3.	LCU-2 fuel				\$	2,500
4.	UCT-1					N/C
5.	FPO-1 Travel				\$	3,992
	FPO-1 Labor				\$	3,075
				Total	*	37 332

1.5 Project Requirements

1.5.1 The Project Execution Plan FPO-1-84(12) specified the Norfolk Harbor Survey to include four forty-foot core samples from the selected range site in the Entrance Reach Channel. The core sites were to be aligned perpendicular to the channel in the general

area where the Sewells Point Spit rises to a 5-foot water depth on the southeast bank of the channel. The channel was redefined to account for future deepening which may occur prior to the installation of this range (see Appendix A). Cores one and two were to be distributed across the modified channel which is the proposed location for the deep water range. Core number three was to be located on the proposed location for the shallow water or minesweep range. The fourth core was to be placed near the five foot water depth on Sewell's Spit which approximates the proposed platform location (see figure 1).

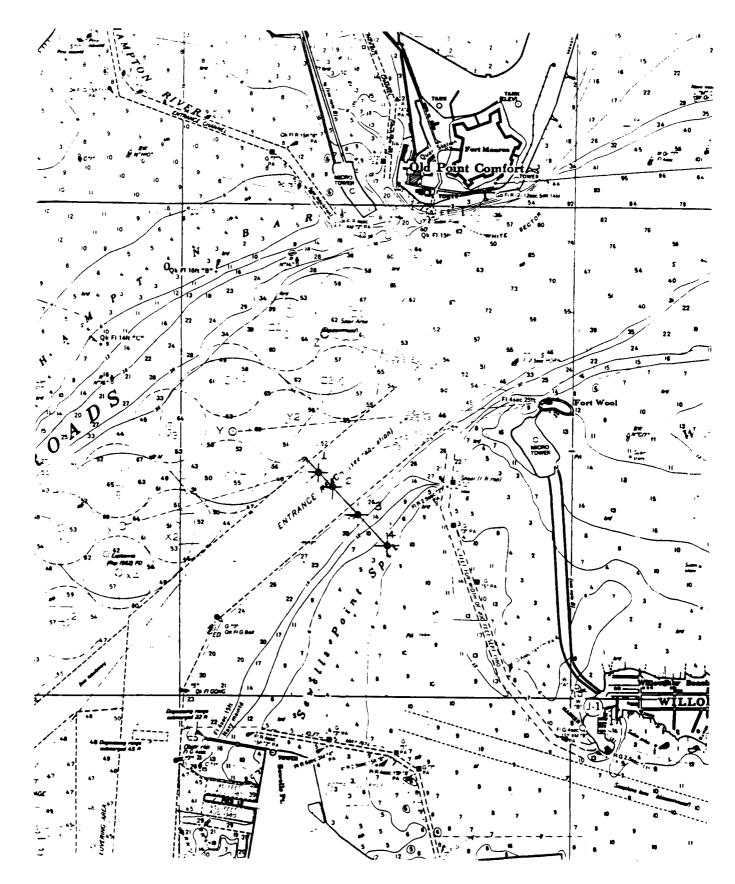
If a forty-foot core was not obtained at each of the four sites due to the corer's inability to vibrate into the sediment (or sediment refusal), the corer was to be fitted for a water jetting capability. The site was to be jetted to determine if penetration to forty feet could be accomplished.

1.5.2 Upon completion of the coring phase of the survey, the core samples were to be transported to LETC testing facilities. All four cores were to be subjected to the following tests:

Soil Identification - per core Sieve Analysis - (ASTM-D422) 4 locations max. Atterberg Limits - (ASTM-D23 and D424) 2 locations max.

In addition, the core obtained from the proposed platform location was to undergo consolidated, undrained triaxial testing every 10 feet or where the layer changes (5 locations max.).

- 1.5.3 Divers were to perform manual probes in twelve locations equally spaced along the proposed cable path from an instrumentation platform to the ranging station on shore Sewell's Point (see Figure Al). The first probe was to be taken at the proposed instrumentation platform site. The remaining eleven probes to be taken along the proposed path would be used to determine the bottom strata's suitability for cable burial to a depth of six feet.
- 1.5.4 Also, current meter readings were to be taken at midchannel for three water column depths at peak ebb and flood tides. Surface environmental information was to be obtained as available such as the existence of prominent prevailing winds or other environmental criteria which would impose specific requirements for the design of the facility.
- 1.5.5 The inclusion of the MSF Deperming Garden extended the survey requirements to encompass a manual bottom probe of the three slips in that facility. The objective was to determine the relative depth of silt deposited in the slips. The number of probes were designated



 $\hbox{U.S. Naval Oceanographic Chart 12245 Showing Site Location}\\$

Figure 1.

as follows: 3 soundings in slips numbers one and three and 2 soundings in slip number two. Additionally, depth measurements were to be taken in the slips to further assist in determining the amount of material which would have to be dredged in order to replace magnetometers and cables.

1.6 Deviation From Requirements

Several items defined in section 1.5 were altered due to on site circumstances. The deviations from the execution plan are presented in the following text.

1.6.1 Core Samples -Degaussing Range

Core sample number three met refusal after an elapsed core time of three minutes and forty-eight seconds and achieved a penetration of approximately thirty feet at refusal. The corer was then fitted with a jetting attachment and the core site was jetted to a depth of forty feet.

Core sample number four was thirty feet in length at the time the liner was removed from the corer. This, however, did not indicate a refusal situation. The strip chart recorder which was attached to the device indicated that 38 to 40 feet of penetration was attained. When the liner was removed from the corer, the "fingers" of the retaining cup were inverted, indicating that part of the sample had fallen out of the core tube due to the inability of the retaining cup to support the sample weight. A second attempt to core near the fourth location was not possible due to the absence of spare core liners.

1.6.2 Current Meter Readings

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The current information was not obtained because the current meter failed to operate properly. It was initially tested at the onset of the survey and found functional; however, simultaneous operation with the vibracorer was not possible due to manpower constraints. Survey personnel went back to take the measurements but the current meter was not functioning nor did it work for the remainder of the survey. When the current meter is again operational, it can be deployed to obtain the current readings.

1.6.3. Deperming Slips - Bottom Probe

The bottom survey of the deperming slips was altered from eight probes to a total of 35 probes distributed among the three slips. This decision was based on discussions with the facility director who explained that during recent operations the magnetometer cables had been damaged due to insufficient clearance between vessel and slip bottom. Thus, a greater number of probes was required to accurately define the extent of silting around the three slips. The revised number of probes were distributed as follows: 12 in slip 3, 13 in slip 2, and 10 in slip 1. An additional four probes were taken in the turning basin area located southeast of the deperming garden. This information was requested by the facility personnel for future planning purposes. The average depth of silt found in this area was 2.5 feet.

SECTION II

PROJECT EXECUTION

2.1 Project Staging

All NCEL, OCEI, and UCT-1 equipment was staged out of Naval Amphibious Base (NAB), Little Creek, Norfolk, Va., by the UCT-1 Detachment assigned to this survey project. The Landing Craft Utility Vessel (LCU) and the small work boat were also acquired from the NAB.

2.2 Project Execution Schedule

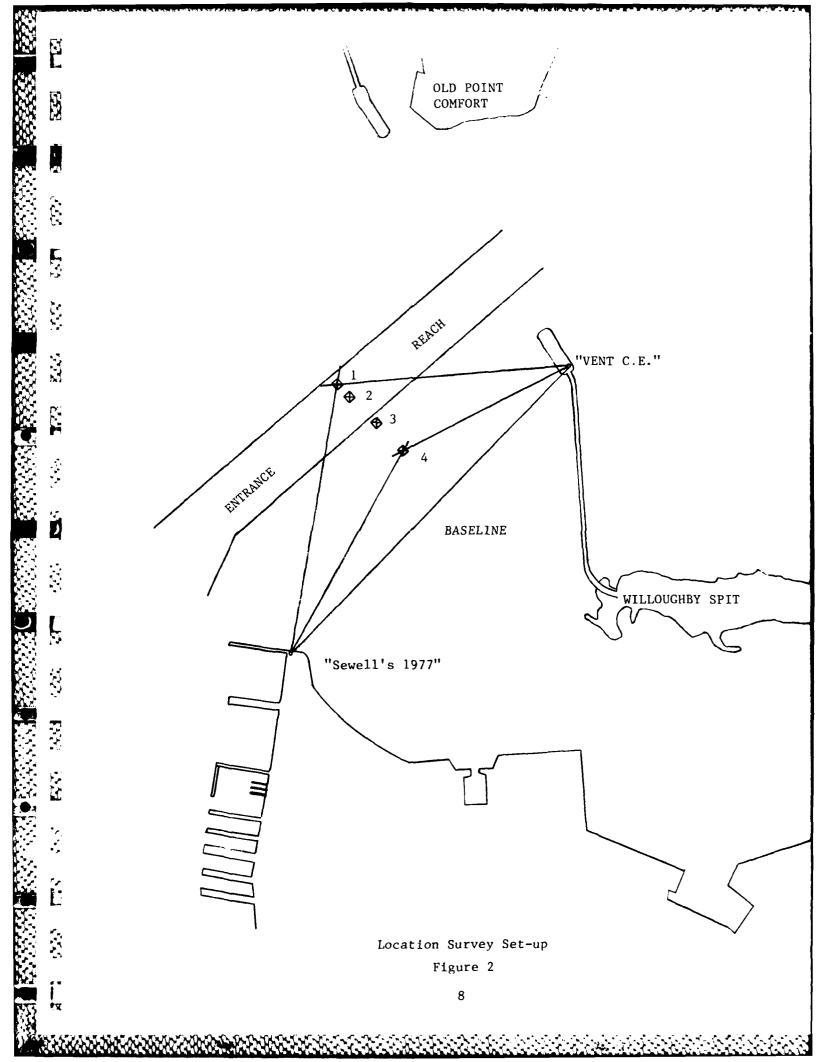
July 7 - 8	LCU mobilization at NAB Little Creek, Va.
July 9 - 10	Set up transits, position LCU, and conducted coring operations
July 11	Demobilization of LCU at NAB Little Creek, Va.
July 12 - 13	Conducted Probe at Deperming Facility
July 14	Final Demobilization of LCU, work boat, and coring gear.

2.3 Preliminary Set-Up

Transits were set-up on "Sewell's 1977" bench mark on the ranging facility grounds and on "Vent C.E." bench mark on the south island of the Hampton Roads Tunnel (see Figure 2). The horizontal control points are of second and third order respectively as documented by the Norfolk District, Corps of Engineers. The Lambert Grid State Plane (South Virginia) coordinates in feet for these two bench marks are given below.

Sewell's 1977	Vent C.E.
236638.663 N	244100.850 N
2635144.571 E	2642153.130 E

The design core site coordinates were presented in the FPO-1-84(12) Execution Plan and are restated in Appendix A. The transit operators obtained a zero reference by backsighting off the opposing bench mark. The angles calculated to locate the core locations are the following:



Core #	"Sewell's 1977"	"Vent C.E."
1	340 61 23.5"	410 21' 14.34"
2	30° 40' 28.21"	370 23' 10.94"
3	230 33' 12.59"	280 55' 23.83"
4	140 10' 13.78"	170 26' 22.5"

Given the limitations of the transits available, the angles were located to the nearest third of a minute. The actual angles turned from each transit to locate the core positons are given below:

Core #	<u>"Sewell's 1977"</u>	"Vent C.E."
1	340 6' 20"	410 21' 20"
2	300 40' 20"	370 23' 20"
3	230 33' 20"	280 55' 20"
4	140 10' 20"	17º 26' 20"

The transit operators utilized radio communications to direct the small workboat to the appropriate locations at which time a marker buoy was released to mark each core site.

2.4 Coring Procedure

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The vibracorer was deployed and retrieved using the 35 ton Grove crane which was operated by a UCT-1 equipment operator. Preparation of the vibracorer was executed as defined in the FPO-1-84(12) Execution Plan. The penetration recording system was tested and in working order. The vibracorer was lifted off the deck of the LCU, swung out over the side, and lowered to the channel floor. The recorder was turned on and the $2^{-1}/2$ " air valve was opened to start the vibrator. Upon indication of approximately 40 feet of penetration, the air valve was shut off and the corer was retrieved. The assembly was lowered to the deck, the kick leg was collapsed, and the corer was laid horizontally on the deck. At this point, the liner containing the core was removed from the corer and was cut into 5' sections which were capped, sealed, and labelled. The core sections were placed in a stand to minimize sediment disturbance.

This procedure was repeated without incident for cores number two and number four. Core number three met refusal at thirty feet and required jetting to forty feet. Also, approximately ten feet of core number four was lost during retrieval; however, the specified penetration had been attained.

2.5 LCU Demobilization

Upon completion of coring operations the LCU returned to the NAB Little Creek, Norfolk, Va., where all project equipment was offloaded for UCT-1 to effect shipment to the respective

points of origin. The core sample segments were taken to UCT-1 base. Law Engineering Testing Company arranged for the transportation of the core samples to their testing facilities. Section 3 presents the LETC test results.

2.6 Cable Path Manual Probe

UCT-1 personnel executed the manual probe from the proposed platform location on Sewell's Spit to the ranging station perimeter. They utilized a length of #6 rebar to probe the proposed cable path. The work boat was positioned on the proposed platform location. The probe was held vertically and lowered to determine the relative water depth at the given location. probe was then forced manually into the sediment from the deck of the work boat and the penetration was recorded. This procedure was repeated for a total of 13 probes along the cable path (see The results from this probe are presented in Table Figure Al). In noting the range of depths obtained, the manual probe alone was not sufficient to determine if a cable burial of six feet can be achieved. Further investigation such as a sub-bottom profile and coring should be conducted in this area to better define the sediment composition. Test results from the cores and profiles can provide a basis for the selection of a cost effective method of cable burial.

2.7 Deperming Slip Probe

See Section 1

The deperming slip survey consisted of 35 probes. The hand-held device used is shown in Figure 3. It was constructed from #6 rebar with 3" rebar segments welded to the rod every foot to simplify measurements in a zero visibility environment. The rebar rod had a perforated steel plate welded to one end. The steel plate served to prevent the rebar from merely piercing the channel bottom sediment which in turn assisted in the determination of the extent of the silt layer. The probe locations are shown in Figure 4. The average depth of silt in slips 1 through 3 was 5.5', 3.4', and 4.3' respectively.

TABLE 1 Sewell's Spit Cable Path Probe Data

PROJECT: Norfolk Survey

LOCATION: Entrance Reach to Sewell's Point

DATE: 12 July 1984

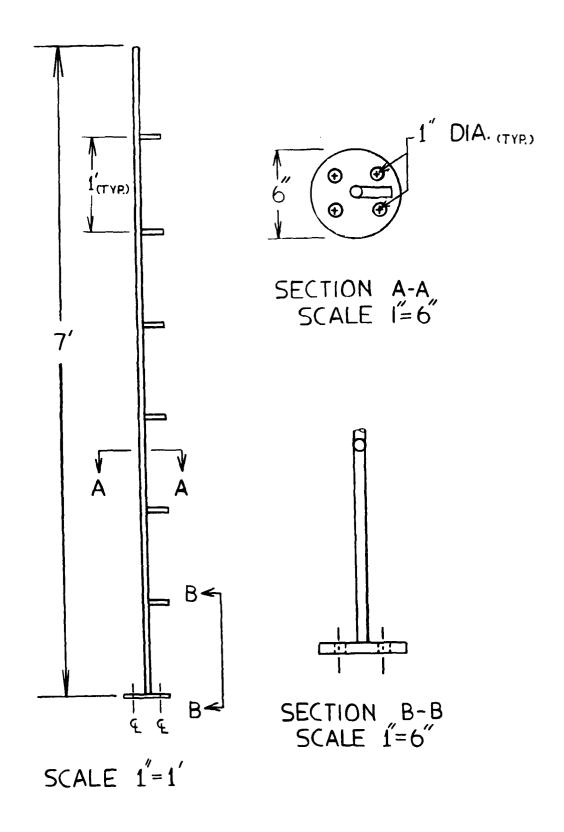
TIDAL RANGE: 3.0' HIGH TIDE: 0830 LOW TIDE: 1433

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SITE	WATER DEPTH	PENETRATION	TIME	COMMENTS
1*	8 '	6 "	1030	Sand
2	8'	4 "	1032	Sand
3	8.5'	6"	1035	Sand
4	9 '	4 "	1037	Sand
5	9 '	4 "	1039	Sand
6	9.5'	4 "	1041	Sand
7	9.5'	4 "	1043	Sand
8	9.5'	7"	1046	Sand
9	9.5'	4 "	1048	Sand
10	۱ و	4 "	1050	Sand
11	8.5'	4"	1054	Sand
12	8 '	4"	1056	Sand
13	10'	18"	1059	Mud

^{*} Proposed platform location



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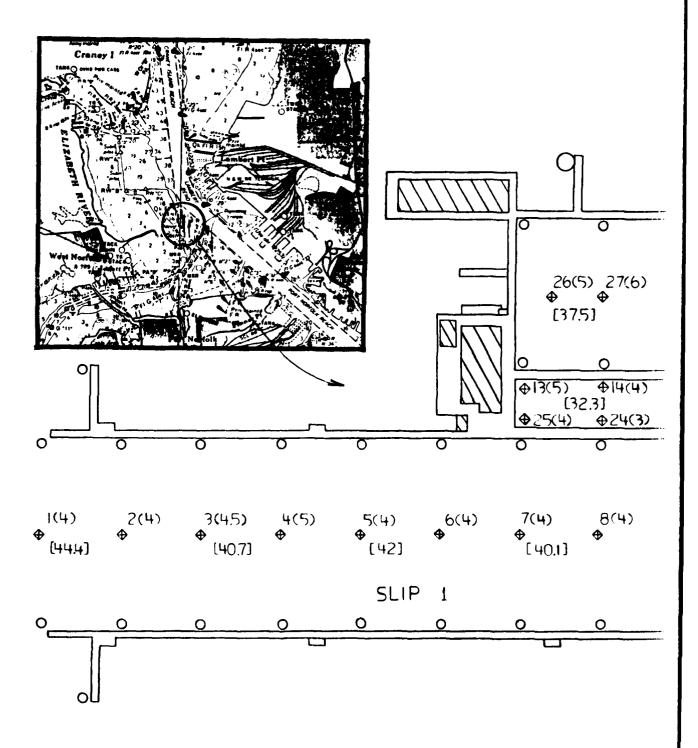
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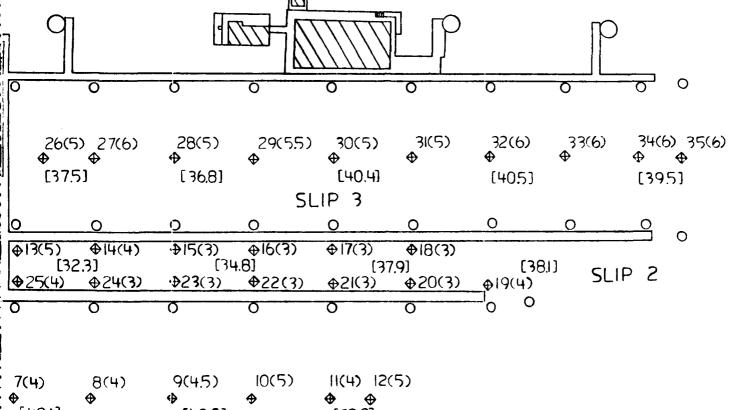
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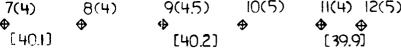
Figure 3. - Device Used For Manual Probe

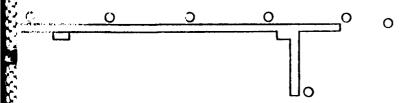


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DEPERMING NAVAL STATE







KEY:

- ◆ PROBE SITE
- # PROBE NUMBER
- (#) DEPIH OF SILT LAYER IN FEET
- #] SOUNDING REFERENCED TO MLW IN FEET

DEPERMING GARDEN NAVAL STATION, NORFOLK

Deperming Slips - Probe Locations Figure 4

SECTION III

RECOMMENDATIONS FOR FUTURE SITE SURVEYS

- 3.1 The following items are presented as recommendations for future site surveys as noted from experiences gained from the Norfolk Harbor survey.
 - * All aspects of the project should be defined beyond question in an execution plan.
 - *For any items not explicitly defined, the execution plan should contain a stipulation that the tasked organization must submit a return "Plan of Execution" such that an approved plan exists before arriving on site.
 - * The project engineer should be consulted on any changes to the execution plan due to on site circumstances.
 - * Spare parts and or maintenance kits should accompany all equipment (as appropriate) that is involved in an at-sea operation. Plan on a worst case situation.
 - * When shipping equipment or other items necessary for an operation, all shipments should allow for ample time to arrive prior to the project start date. Also, all shipments must be tracked (in process) by the originator to ensure arrival. Request check-in (to the originator) of equipment at each transfer level.

SECTION IV

CORE SAMPLE TEST RESULTS

A. Consolidated Undrained Test Results



LAW ENGINEERING TESTING COMPANY

791.3 WESTPARK DRIVE P.O. DRAWER QQ+McLEAN VIRGINIA 22101-0700 (703) 790-5700

September 13, 1984

VSE Corporation 2550 Huntington Avenue Alexandria, Virginia 22303

ATTENTION: Bill Walker

SUBJECT: Results of CU Triaxial Tests

Degaussing Range Norfolk Navy Contract N00600-82-D002 LETCO Project No. W4-4519

Dear Bill,

The requested laboratory testing on Core 4 has been completed. The results of five consolidated-undrained triaxial compression tests with pore pressure measurements are attached. The clayey to silty sands exhibited an average effective stress friction angle of about 32 degrees. The undrained shear strengths (defined at maximum deviator stress) are summarized as follows:

Core	Depth* (Ft)	Confining Stress (ksf)**	C _u (ksf)	C _u /P _o '
4E	5.5	0.43	1.12	2.60
4D	13.5	0.79	0.79	1.00
4C	18.5	1.01	0.35	0.35
4B	24.5	1.44	0.56	0.39
4A	27.5	1.73	1.03	0.59

^{*} below mud line

Also enclosed are the visual classifications on all four cores as requested by Mr. Allan Hubler.

Very truly yours, LAW ENGINEERING TESTING COMPANY

Paul W. Mayne, P.E.

Senior Geotechnical Engineer

Enclosures PWM/ab

^{**} estimated overburden (Po')

LAW ENGINEERING TESTING COMPANY

PA STATE CONTRACTOR

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SOIL DATA SUMMARY

BORING	SAMPLE	SAMPLE	SOIL	UNIT W	ЕІСНТ	% FINER NO. 200	SPECIFIC	VOID	NATURAL MOISTURE	ATTE	ATTERBERG LIMITS	G ADDITIONAL TESTS CONDUCTED
NO.	DEPTH (FT.)		CLASSIFICATION	Wet	Dry	SIEVE	GRAVITY	RATIO	%	Г.Т.	P.L. P	P.I.
1-н	0-5	αn	(CH or MH)			94.5						
1-G	5-10	αn	(CL)			> 50				42	20	22
1-F	10-15	αn	(CH or MH)			79.8						
1-E	15-20	dn	СН			98.2			88.0	91	35	56
1-D	20-25	ΩĎ	(CH or MH)			97.5						
1-c	25-30	αn	(сн)			> 50				79	31 4	48
1-B	30-35	αn	(CH OF MH)			1.66						
2-H	9-0	άn	(CH Or MH)			64.8						
2-G	5-10	ΩD	(сн)			> 50				74	26 4	48
2-F	10-15	αn	(CH OF MH)			93.1						
2-E	15-20	UD	СН			99.0			74.5	77	32 4	45
2-D	20-25	an	(CH or MH)			98.7						
2-C	25-30	αn	(сн)			> 50				94	36 5	28
2-B	30-35	αn	(SC or SM)			8.8						
OGEOIA			Manifester Avi	o Manifest of Agrae	Standards.		QQ	PP O IFOT NAME		Dograma Dange	Ç.	Ç

1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System NOTES:

() - Symbol represents visual classification

PROJECT NAME Degaussing Range

PROJECT NUMBER

W4-4519

Norfolk, Virginia

PROJECT LOCATION

LAW ENGINEERING TESTING COMPANY

STATES STATES

STATES OF THE STATES

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SOIL DATA SUMMARY

BORING	SAMPLE	SAMPLE	SOIL	UNIT WE	EIGHT	% FINER NO. 200	SPECIFIC	VOID	NATURAL	ATT	ATTERBERG LIMITS	<u> </u>	ADDITIONAL TESTS CONDUCTED
NO.	DEPTH (FT.)		CLASSIFICATION	Wet	Dry	SIEVE	GRAVITY	RATIO	8%	L.L.	P.L.	P.I.	
3-F	0-5	αn	(CH Or MH)			77.0							
3-E	5-10	αn	(CT)			> 50				32	22	10	
3-D	10-15	αn	(CH or MH)			57.5							
3-C	15-20	αn	TO			78.5			47.0	43	18	25	
3-B	20-25	αn	(CH Or MH)			91.4							
3-A	25-30	αn	НЭ			99.5				74	29	45	
4-F	0-5	αn	(SC or SM)	127.8	104.9	13.7	2.66	. 582	21.9				UU Triaxial
4-E	5-10	ΩΩ	(WS)	122.1	96.9	< 50	2.68	.726	26.0	15	ďΝ	1	UU Triaxial
4-D	10-15	αn	(SC or SM)			34.4							
4-C	15-20	αn	sc	118.6	92.7	39.6	2.69	.81	27.9	28	19	6	UU Triaxial
4-B	20-25	an	(SC or SM)	115.8	85.9	23.2	2.68	.947	34.8				UU Triaxial
4-A	25-30	αn	SM	126.9	104.1	15.7	2.68	.607	22.0	14	ď	-	UU Triaxial
OGEO!	A Coult have		old soile and deim south	A Patro A	Standards		10	PROTECT NAME		วลบรร	Degaussing Range	Zange	

NOTES: 1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System

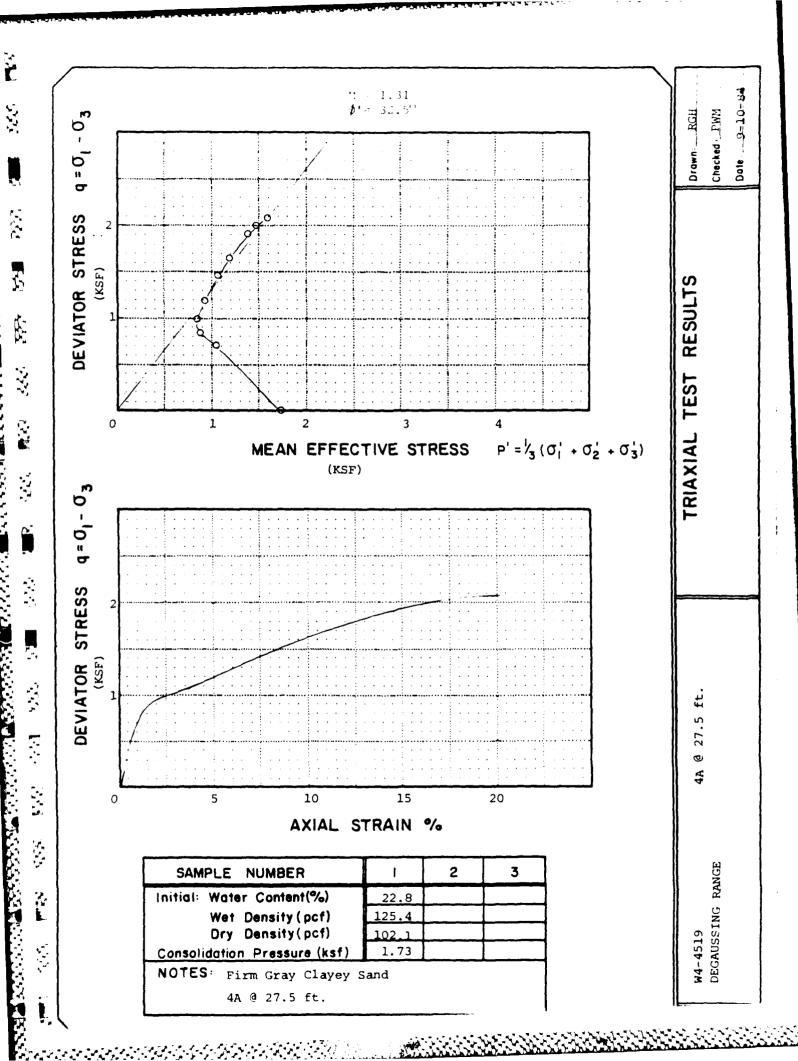
() - Symbol represents visual classification

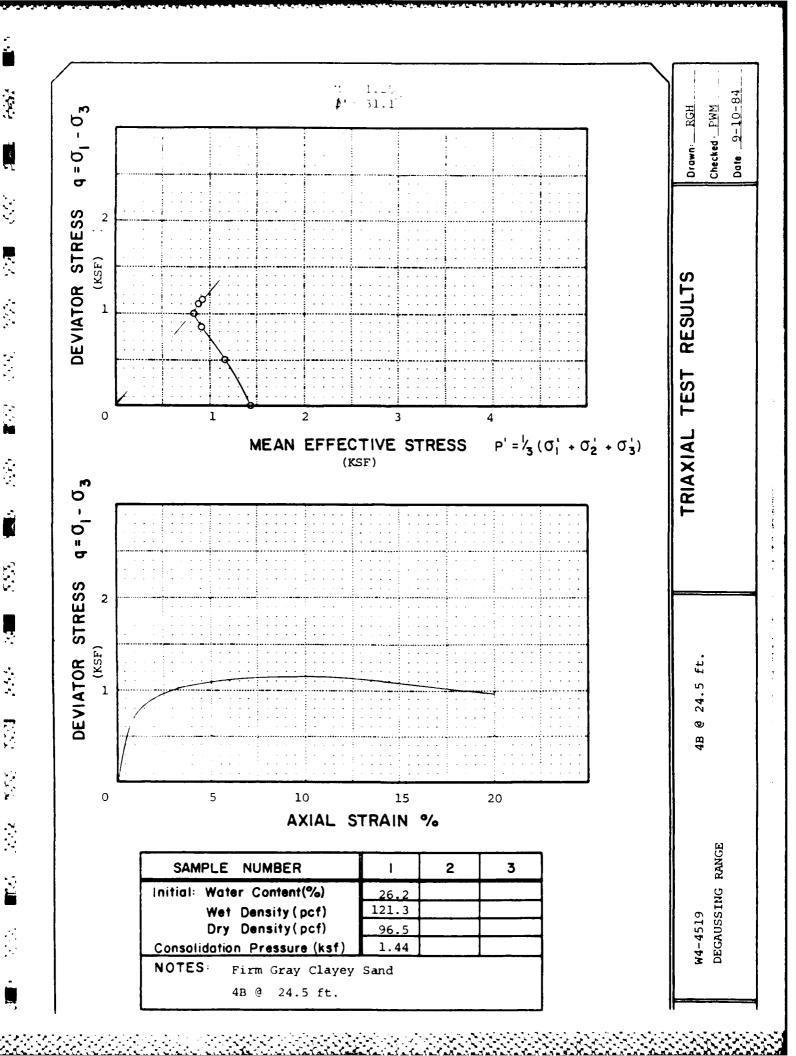
PROJECT NAME Degaussing Range

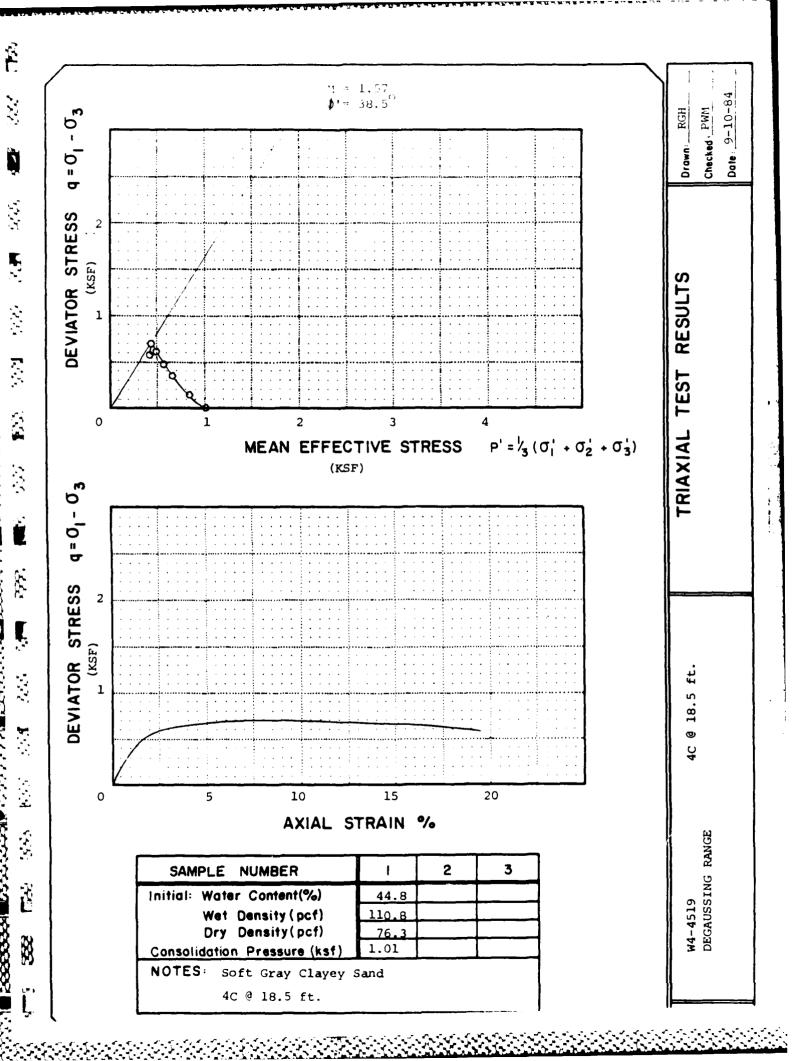
PROJECT NUMBER W4-4519

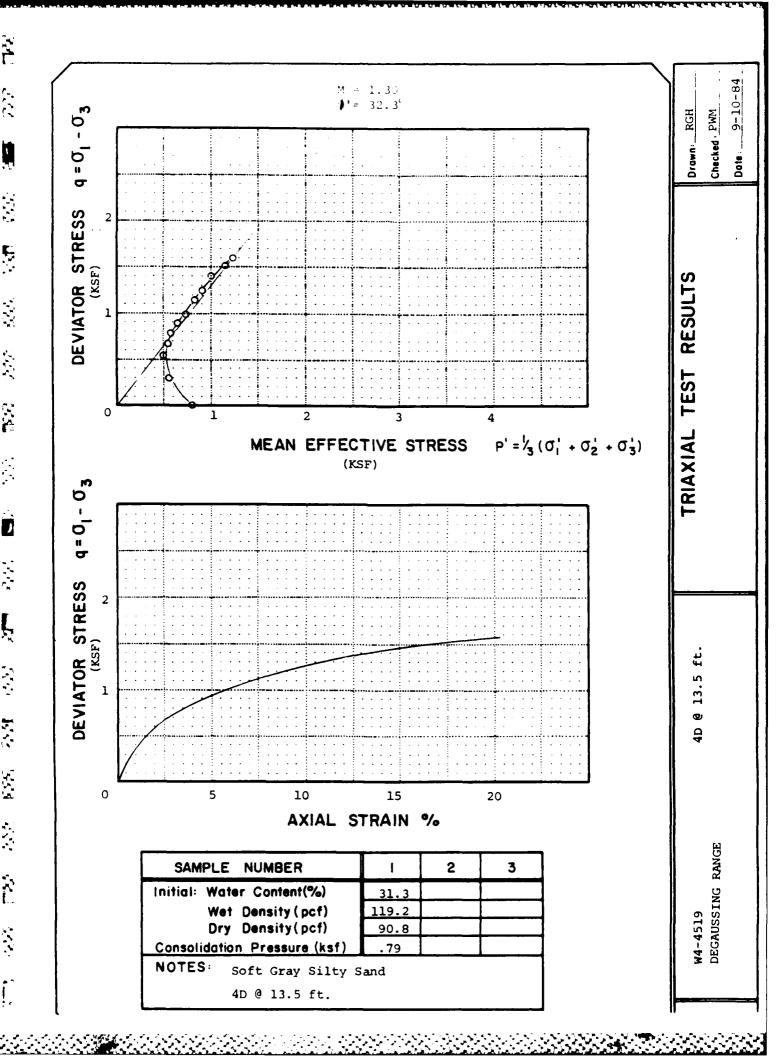
Norfolk, Virginia

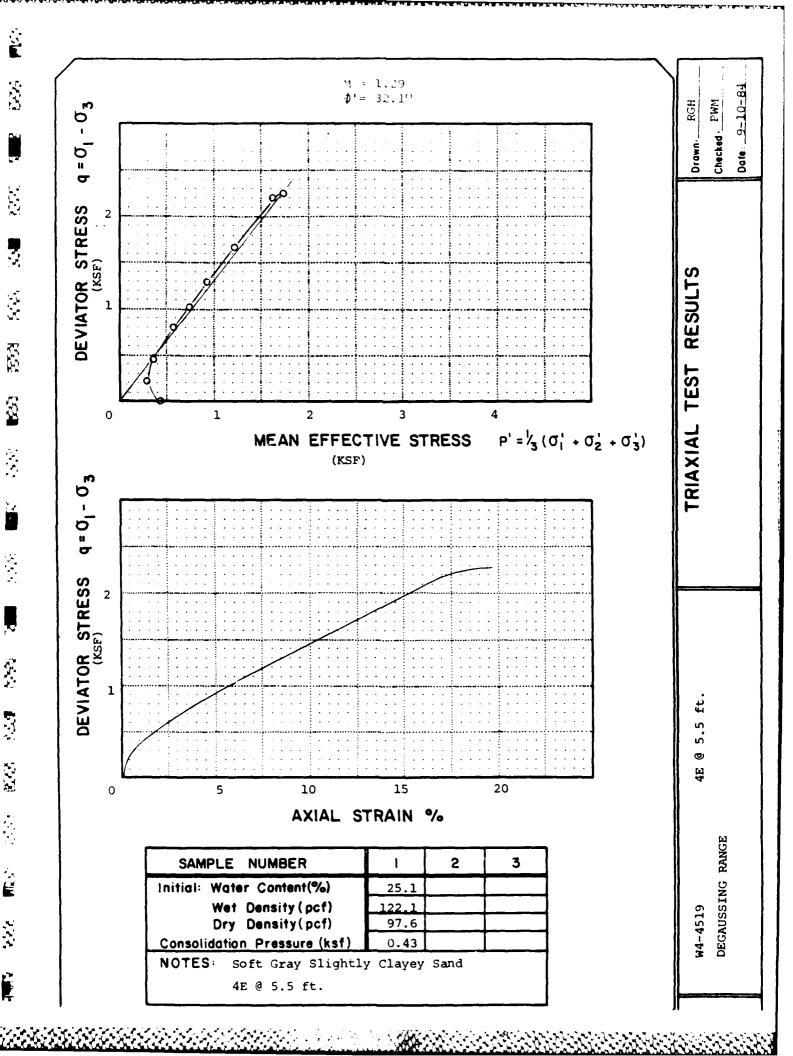
PROJECT LOCATION











WOODER TO CONTRACT TO STAND THE STANDARD TO STAND THE STANDARD TO STANDARD THE STAN

HAR THE WEST CONTROL OF THE PROPERTY OF THE PR

ANGE 14 ANGE 34 45.9 DELACERING RANGE 5 S NO GENERAL SECTION OF 4A UP @ 27 5 FT LAMELS DURING LATER N. 2 F.RM. GRAY GLAYEY DANG

JUNEAU PATED UNDRAINED COMPRESSION FEST WITH STRAIN CONTROL

PROVING RING .433 PALIBRATED 3 1984

hare success success.

INITIAL CONSOLIDATED PROPERTY 4 186 INCHES HEIGHT **4 233** VOID RATIO 597 650 = 3 225 = 22.81 3.157 SQ IN AREA PERCENT MOISTURE 22 13 PERCENT WET DENSITY = 125.41 128.81 PCF DRY DENSITY = .02 12 105 47 PCF PERCENT SATURATION = 94.77 100 00 PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

O U T P U T - D A T A

READING	STRAIN	SHEAR	VOLUME	VOID	A
NUMBER		STRAIN	STRAIN	RATIO	FACTOR
	(IN/IN)		(CC/CC)		
1	000000	000000	0000	597	000
2	008360	008360	0000	. 597	1 299
3	014810	014810	0000	597	1 346
4	028186	028186	0000	597	1 237
5	034636	034636	0000	597	1 177
٤	047773	.047773	0000	597	1 022
7	061150	061150	0000	5 9 7	915
8	080976	080976	0000	597	783
9	100802	100802	0000	597	. 657
10	120867	120867	0000	597	580
1 1	140932	140932	0000	59 <i>7</i>	514
. 2	160519	160519	0000	597	. 464
1 3	180106	180106	0000	597	435
. 4	202560	202560	0000	597	406

READING	SIGI	PWP	EFF	EFF	TOTAL	EFF	a	P	Q / P
NUMBER	(KSF)	(KSF)	SIGI	SIC3	STRESS	STRESS	(KSF)	(KSF)	
			(KSF)	(KSF)	RATIO	RATIO	CAMBRI	DGE PARA	METERS
	1 73	00	1 73	1 73	1 00	1 00	00	173	0 0
2	2 44	9 2	1 51	8 1	1 41	1.88	7 1	104	68
3	2 56	1 13	1 44	60	1 48	2 39	8 4	88	95
4	2 73	1 24	1 49	49	1 58	3 0 3	1 00	8 3	1 21
i	2 28	1 24	1 54	48	1 6 1	3 18	1 0 6	8 4	1 26
5	2 9 2	1 22	1 70	5 1	1 69	3 34	1 19	9 1	1 31
7	3 05	i 2 i	1 84	5 2	1 76	3 5 5	1 32	96	1 38
8	3 2 1	1 16	2 05	57	185	3.59	1 48	106	1 39
9	3 37	1 08	2 2 9	65	1 95	3 5 5	1 65	1 19	1 38
٠. ن	3 49	1 03	2 47	70	2 0 2	3 51	1 77	1.29	1 37
1.	3 43	98	2 65	75	2 10	3 5 3	1 90	1 38	1 37
. 2	3 73	93	2 80	80	2 16	3 5 1	2 0 1	1 47	1 37
. 3	3 74	8.8	2 87	8 5	2 17	3 36	2 0 1	1 52	1 32
: 4	3 79	8 4	2 96	8 9	2 20	3 32	2 07	1 58	1 31

LAW ENGINEERING TESTING COMPANY TRIAXIAL SHEAR TEST

PROJECT NAME & NO. ARE W4-4519 DEGAUSSING RANGE BORING NUMBER IS CORE 48 UD @ 24 FT SAMPLE IDENTIFICATION IS FIRM GRAY SILTY SAND

CONSOL DATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

SEE HEREIN, DINNE SUUNIG

SANTAN SA

PROPERTY	1	INITI	AL	CUNSOLIDATED
HEIGHT	*	4 3	71	4 290 INCHES
VOID RATIO	=	7	53	660
AREA	22	3 2	57	3 143 SQ. IN
PERCENT MOISTURE	=	26	18	24 36 PERCENT
VET DENSITY	=	121	75	126 67 PCF
DRY DEMSITY	*	96	49	101 86 PCF
PERCENT SATURATION	=	94	28	100 00 PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

OUTPUT DATA

READING	STRAIN	SHEAR	VOLUME	DIOV	A
NUMBER		STRAIN	STRAIN	RATIO	FACTOR
	(IN/IN)		(CC/CC)		
1	000000	00000	0000	660	000
2	006293	006293	0000	660	859
3	016083	014083	0000	660	973
4	031933	031933	0000	660	952
3	044986	944986	0000	460	948
6	057805	057805	0000	660	906
7	077152	077152	0000	460	841
8	096265	096265	0000	660	796
9	122370	122370	0000	660	788
10	i 48243	148243	0000	660	811
1.1	173883	173683	0000	660	862
1 2	199522	199522	0000	460	937
READING NUMBER	Sigi PWP (KSF) (KSF)	EFF EFF SIG1 SIG3	TOTAL EFF STRESS STRESS	Q (KSF) (P Q/P
		(KSF) (KSF)	RATIO RATIO		PARAMETERS
à.	1 44 00	1 44 1 44	1 00 1 00		.44 00
2	1 95 43	1 51 1 01	1 35 1 50	51 1	17 43
3	2 2 9 8 3	1 46 61	1 59 2 38	8.5	90 95
4	2 45 96	1 49 48	1 70 3 09	1 0 1	82 i 23
5	2 45 96	1 49 48	1 70 3 12	1 0 1	82 1 24
6	2 48 94	1 54 50	1 72 3 10	1 04	84 1 24
7	2 54 93	1 61 51	1 77 3 15	1 10	88 1 25
8	2 58 91	1 67 53	1 79 3 14	1 14	91 1 2 5
9	2 57 89	1 68 55	1 78 3 04	1 13	93 1 2 1
10	2 53 89	1 65 55	1 76 2 98	1 09	92 1 1 9
11	2 48 90	1 58 54	1 72 2 92	1 04	89 1 17
1 2	2 41 91	1 50 53	1 68 2 85	97	85 1 14

AW STANDER IN DELICING DATE AND TRANSPORTED TRANSPORTED TO THE AREA OF THE AMERICAN TO THE AME

TO COLUMN ARTHUR AND MANUAL ASIA DE JAUSSING RANGE OF BURN NUMBER 15 AC UD & 18 S FT.

AMPLE LEATIFULATION 15 SOFT SRAY CLAYEY BAND

JUNECULEATED UNDRATNED COMPRESSION TEST WITH STRAIN CONTROL

EROVING RING 1433 CALIBRATED 3 / 1984

PROPERTY 1 E 3

UPECLE, C GRAV.TY 2 72

L.QU.D EIMIT = 0

PLASTIC LIMI: = 0

MEASURED VOLUME CHANGE = 872 IN3

IDLL PRESSURE 4 3 89 KSF

LONSOL, DALION PRESSURE 4 1 01 KSF

POSSESSES ACOUNTS CONTRACT CONTRACTOR SECRETARY

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

UUTPUT DATA

READING	STRAIN	SHEAR	VOLUME	diov	A
NUMBER	3111111	STRAIN	STRAIN	RATIO	FACTOR
	(IN/IN)		(CC/CC)		
	000000	000000	0000	1 085	000
2	003732	003732	0000	1 085	1 627
3	010496	010496	0000	1 085	1 384
4	016793	016793	0000	1 085	1 209
ذ	029621	029621	0000	1 085	1 150
3	043382	043382	0000	1 08	1 062
•	061808	061808	0000	1 085	1 091
8	074870	074870	0000	1 085	1 132
9	093995	093995	0000	1 085	1 138
. 0	1:3354	113354	0000	1 085	1 134
1.	132946	132946	0000	1 085	1 243
: 2	.52072	152072	0000	1 085	1 194
: 3	173996	173996	0000	1 085	1 272
. 4	193588	193588	0000	1 085	1 326

READING	3	5 I G i	PWP	EFF	EFF	TOTAL	EFF	Q.	P	Q/P
NUMBER		(SF)	(KSF)	SIGI	SIGS	STRESS	STRESS	(KSF)	(KSF)	
				(KSF)	(KSF)	RATIO	RATIO	CAMBRID	GE PARA	METERS
		o.	UU	1 0 1	1 0 1	1 00	1 00	00	1 0 1	00
2		14	2 2	92	79	1 13	1 17	14	8 3	16
5		J 4	47	8 8	5 4	1 33	1 62	3 4	65	5 1
4	1	50	5 9	90	4.1	1 49	2 18	49	5.8	8 5
4	1	6 4	71	91	30	1 6 1	3 0 5	62	50	1 22
6	i	70	74	96	27	1 69	3 5 6	69	50	1 38
7	1	7.1	77	94	2 4	1 70	3 90	70	48	1 47
8	1	20	78	9 2	2 2	1 69	4 08	69	46	1 52
ş		~ 1	79	٠,	2 1	1 69	4 27	? 0	45	1 57
: 0	:	2.1	8 0	91	2 1	1 70	4 3 4	70	44	1 58
		5 6	8 1	8.5	20	1 64	4 2 1	6.5	4 2	1 55
i 2	1	68	8 0	88	2 0	1 67	4 2 9	67	4.3	1 57
. 3		63	79	84	2 2	1 61	3 78	6.2	43	1 44
. 4	ì	5 7	75	B 2	26	1 56	3 2 1	\$ 7	44	1 27

LAW ENGINEERING JESTING JOHEANY TRIAXIAL SHEAR TEST

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

DAMPLE IDENTIFICATION 15 SOFT GRAY SILTY SAND		J	Name Change (Alice Change) and American Change						- Park Bark Bark Bark San
DAMPLE IDENTIFICATION 15 SOFT GRAY SILTY SAND	2	K							
DAMPLE IDENTIFICATION IN SUFT GRAY SILTY SAND CONSOLUDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL PROVING RING (433 CALIBRATED 3) 1984	255353							PHA 3 PH	
HEIGHT			DMIRUE	NUMBER IS 4-	O UD @ 13 5	FT			
HEIGHT			CONSOL.	ATED UNDRAIL	NED COMPRESS	ION TEST W	TTH STR	AIN CONT	ROL
HEIGHT			PROVING						
HEIGHT	X			CHAVITY	= 2 70				
HEIGHT			PLASTIC	LIMIT	= 0				
HEIGHT = 4 284 241 INCHES VOID RATIO = 854 800 AREA = 3 179 J 115 SG IN PERCENT MOISTURE = 31.92 29 62 PERCENT WET DENSITY = 119 19 121 34 PCF DRY DENSITY = 119 19 121 34 PCF DRY DENSITY = 70 76 79 36 1 PCF PERCENT SATURATION = 98 76 100 00 PERCENT NOTE - CUNSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHA O U T P U T D A T A AEADING STRAIN SHEAR VOLUME VOID A STRAIN RATIO FACTOR (CC/CC) 1 000000 000000 000000 0000 79 000 79 1174 3 012731 012731 00000 79 859 4 019097 019097 0000 79 859 5 023463 023463 0000 79 859 6 038646 038646 0000 79 92 100 7 007372 097372 0000 79 100 9 097372 097372 0000 79 100 1 1 1 1 149712 149712 0000 79 100 1 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1)	em.	CLLL PRI	ISSURE	= 3 67	KSF			
HEIGHT = 4 284 241 INCHES VOID RATIO = 854 800 AREA = 3 179 J 115 SG IN PERCENT MOISTURE = 31.92 29 62 PERCENT WET DENSITY = 119 19 121 34 PCF DRY DENSITY = 119 19 121 34 PCF DRY DENSITY = 70 76 79 36 1 PCF PERCENT SATURATION = 98 76 100 00 PERCENT NOTE - CUNSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHA O U T P U T D A T A AEADING STRAIN SHEAR VOLUME VOID A STRAIN RATIO FACTOR (CC/CC) 1 000000 000000 000000 0000 79 000 79 1174 3 012731 012731 00000 79 859 4 019097 019097 0000 79 859 5 023463 023463 0000 79 859 6 038646 038646 0000 79 92 100 7 007372 097372 0000 79 100 9 097372 097372 0000 79 100 1 1 1 1 149712 149712 0000 79 100 1 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 100 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149712 149712 0000 79 1047 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 149713 171 171 2 0000 79 1047 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	}	3							
AREA PERCENT HOISTURE = 31.92 29 42 PERCENT PERCENT HOISTURE = 119 19 121.14 PCF DRY DENSITY = 119 19 121.14 PCF DRY DENSITY = 90.74 93.41 PCF PERCENT SATURATION = 78.76 100.00 PERCENT NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM HEASURED VOLUME CHA OUT PUT DATA SEADING STRAIN SHEAR VOLUME VOID A NUMBER (IN/IN) (CC/CC) 1 000000 0000000 00000 79.9 0000 2 003301 003301 0000 79.9 1174 3 012731 012731 0000 79.9 85.9 4 019097 019097 0000 79.9 85.9 4 019097 019097 0000 79.9 476 5 025463 025463 0000 79.9 477 6 038464 038464 0000 79.9 476 7 058470 058470 0000 79.9 136 8 077803 077803 0000 79.9 136 9 097372 097372 0000 79.9 136 9 097372 097372 0000 79.9 136 11 149712 149712 0000 79.9 136 12 149712 149712 0000 79.9 136 12 1 1 149712 149712 0000 79.9 136 12 1 1 149712 149712 0000 79.9 003 13 188850 188650 0000 79.9 04.7 14 202524 202524 0000 79.9 04.7 15 1 1 149712 149712 149712 0000 79.9 04.7 16 1 1 149712 149712 149712 0000 79.9 0.9 16 13 188850 188650 0000 79.9 0.9 17 14 15 188850 188650 0000 79.9 0.9 18 16 17 18 18 18 18 18 18 18 18 18 18 18 18 18	ĺ	16	HEIGHT	;	= 4 286	4 241 IN			
DRY DENSITY = 90 76			AREA	1			IN		
PERCENT SATURATION = 98 74 100 00 PERCENT NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHA O U T P U T D A T A READING STRAIN SHEAR VOLUME VOID A STRAIN STRAIN RATIO FACTOR (1N/IN) 1 000000 000000 00000 79 0000 79 1174 3 012731 012731 00000 79 859 4 019997 019097 0000 79 859 6 038666 038666 038666 0000 79 49 476 7 058470 038470 0000 79 393 8 077803 077803 0000 79 393 8 077803 077803 0000 79 136 9 097372 097372 0000 79 136 9 097372 097372 0000 79 136 11 149712 149712 0000 79 136 12 123778 123778 0000 79 136 13 188850 12831 109281 0000 79 136 13 188850 188850 0000 79 067 14 202024 202524 0000 79 067 15 17 9 -2 88 3 67 36 1 37 1 66 29 54 5 NUMBER (KSF) (KSF) SIGI SIG3 STRESS STRESS (KSF) (KSF) (KSF) (KSF) RATIO RATIO CAMBRIDGE PRAMATETE 1 79 -2 88 3 67 36 1 00 1 00 0 3 67 0 2 1 09 35 74 45 1 37 1 66 29 54 5 3 33 34 88 87 31 1 71 2 80 56 50 1 1 4 1 46 50 96 29 1 84 3 27 67 52 1 2 1 1 36 44 1 24 35 2 13 3 56 89 65 1 3 1 1 94 35 1 59 44 2 45 3 41 1 15 5 2 1 1 3 1 1 2 2 37 11 2 27 69 2 99 3 30 1 58 1 21 1 3 1 2 37 11 2 27 69 2 99 3 30 1 58 1 21 1 3 1 2 37 11 2 27 69 2 99 3 30 1 58 1 21 1 3 1 3 2 37 11 2 27 69 2 99 3 30 1 58 1 21 1 3									
NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHA OUTPOUT DATA)								
NUMBER STRAIN SHEAR VOLUME VOID A NUMBER CIN/IN) (CC/CC)	•							FACUERN '	WOLLOWS CHAI
READING NUMBER (IN/IN) STRAIN STRAIN (CCC/CCC) 1 000000 000000 00000 79 000 79 000 79 859 174 174 174 174 175 175 175 175 175 175 175 175 175 175	֝֟֟֝֟֝֟֟֝֟֝֟֟֝֟֝֟֟֝֟֟֝֟֟	_	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						VOLUME CHA
NUMBER (1N/IN) (1N/IN) (100000 000000 00000 79, 0000 79, 1174 2 003301 003301 0000 79, 1174 3 0112731 0000 79, 859 4 019097 019097 0000 79, 747 5 025463 025463 0000 79, 446 7 038666 038666 03000 79, 476 6 038666 038666 0000 79, 393 8 077803 077803 0000 79, 393 8 077803 077803 0000 79, 247 10 123778 123778 0000 79, 247 11 149712 149712 0000 79, 136 12 149281 169281 0000 79, 136 13 188850 188850 0000 79, 003 13 188850 188850 0000 79, 003 14 202524 202524 0000 79, 003 15 188850 188850 0000 79, 003 16 188850 188850 0000 79, 003 17 19 19 10 10 10 00 79, 060 READING SIGI PWP EFF EFF TOTAL EFF Q P Q/NUMBER (KSF) (KSF) SIGI SIG3 STRESS STRESS (KSF) (KSF) (KSF) (KSF) RATIO RATIO CAMBRIDGE PARAMETE (KSF) (KSF) 11 11 12 14 14 14 14 14 14 14 14 14 14 14 14 14	1								
1 000000 000000 797 0000 797 174 174 3 012731 012731 01000 797 174 174 3 012731 012731 0000 799 859 859 4 019097 019097 0000 799 747 747 859 859 859 859 859 859 859 859 859 859	7	Ţ.		STRAIN					A FACTOR
3 012731 0000 799 859 4 019097 019097 00000 799 747 5 025463 025463 00000 799 629 6 038666 038666 00000 799 496 7 058470 058470 00000 799 393 8 077803 077803 0000 799 393 8 077803 077803 0000 799 306 9 097372 097372 00000 799 247 10 123778 123778 00000 799 184 11 149712 149712 0000 799 184 12 169281 169281 0000 799 093 13 188850 188850 0000 799 093 13 188850 188850 0000 799 067 14 202324 202524 00000 799 067 14 202324 202524 00000 799 067 17 7 -2 88 3 67 3 67 1 00 1 00 0 3 67 00 17 9 18 18 18 18 18 18 18 18 18 18 18 18 18		£*	1					79 ≠	000
### 1		Ö							
6 038666 038666 0000 799 496 7 058470 058470 0000 799 393 8 077803 077803 0000 799 396 9 097372 097372 00000 799 306 10 123778 123778 00000 799 184 11 149712 149712 0000 799 136 12 169281 169281 0000 799 093 13 188850 188850 0000 799 067 14 202524 202524 00000 799 066 READING SIGI PWP EFF EFF TOTAL EFF 0 P Q/ NUMBER (KSF) (KSF) SIGI SIG3 STRESS STRESS (KSF) (KSF) (KSF) (KSF) (KSF) STRESS STRESS (KSF) (KSF) 2 1 197 35 74 45 1 37 1 64 29 54 29 54 3 67 1 30 1 00 0 0 3 67 0 3 3 3 3 48 87 31 1 71 280 56 50 1 1 4 1 4 6 50 96 29 1 84 3 27 67 52 12 1 1 1 6 8 44 1 24 35 2 1 3 3 56 89 65 1 3 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			4	019097	01909	7 00	00	799	747
8 077803 077803 0000 799 304 9 097372 097372 0000 799 247 10 123778 123778 0000 799 184 11 149712 149712 0000 799 134 12 169281 169281 0000 799 093 13 188850 188850 0000 799 060 READING SIGI PWP EFF EFF TOTAL EFF Q P Q/ NUMEER (KSF) (KSF) SIGI SIG3 STRESS STRESS (KSF) (KSF) (KSF) (KSF) (KSF) RATIO RATIO CAMBRIDGE PARAMETE 1 79 -2 88 3 47 3 47 1 00 1 00 00 3 47 0 2 1 09 35 74 45 1 37 1 46 29 54 5 3 .35 48 87 31 171 2 80 56 50 1 1 4 1 46 50 96 29 1 84 3 27 67 52 1 2 1 1 36 4 4 1 08 31 1 98 3 3 3 77 56 1 3 6 1 68 44 1 24 35 2 13 3 3 56 89 65 1 3 6 1 68 44 1 24 35 2 13 3 56 89 65 1 3 9 2 04 31 1 73 48 2 37 3 58 1 25 90 1 3 10 2 18 26 1 92 54 2 75 3 59 1 39 1 00 1 3 11 2 2 32 14 2 17 65 2 92 3 34 1 52 1 16 13 13 2 37 11 2 27 69 2 99 3 30 1 58 1 21 13 13 2 37 11 2 27 69 2 99 3 30 1 58 1 21 13 13 2 37 11 2 27 69 2 99 3 30 1 58 1 21 13		~ .	6	038666	03866	6 00	00	799	496
10 123778 123778 0000 799 184 11 149712 149712 0000 799 136 1 14 149712 149712 0000 799 136 13 188850 188850 0000 799 067 14 202524 202524 00000 799 060 14 202524 202524 00000 799 060 16 18 18 18 18 18 18 18 18 18 18 18 18 18		~							
12 169281 169281 0000 799 093 13 188850 188850 0000 799 060 READING SIG1 PWP EFF EFF TOTAL EFF Q P Q/ NUMBER (KSF) (KSF) SIG1 SIG3 STRESS STRESS (KSF) (KSF) (KSF) (KSF) RATIO RATIO CAMBRIDGE PARAMETE 1 79 -2 88 3 67 3 67 1 00 1 00 00 3 67 00 2 1 09 35 74 45 1 37 1 64 29 54 5 3 .35 48 87 31 1 71 2 80 56 50 11 4 1 46 50 96 29 1 8 84 3 27 67 52 1 2 1 1 36 49 1 08 31 1 98 3 53 77 56 1 3 6 1 68 44 1 24 35 2 13 3 56 89 65 1 3 7 1 79 39 1 40 40 2 27 3 52 1 00 73 1 3 8 1 79 35 1 59 44 2 45 3 61 1 15 82 1 3 9 2 04 31 1 73 48 2 57 3 58 1 25 90 1 3 10 2 18 26 1 92 54 2 75 3 59 1 39 1 00 1 3 11 2 26 20 2 06 59 2 85 3 47 1 46 1 08 1 3 12 2 32 14 2 17 65 2 92 3 34 1 52 1 16 1 3 13 2 37 11 2 27 69 2 99 3 30 1 58 1 21 13 13 2 37 11 2 27 69 2 99 3 30 1 58 1 21 13		_							
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READING	:	SIGI	PWP	1	EFF	EFF	TO.	TAL	E	FF		Q.	F	1	C	1 / P
NUMBER	(1	KSF)	(KSF)	9	31G1	SIG3	ST	RESS	STI	RESS	()	(SF)	() (SF)		
				()	(SF)	(KSF)	RA'	rio	RAT	rio	C.	MBR	DGE	PAR	AMET	ERS
1		79	-2 88	3	67	3 67	1	00	1	00		00	3	67		00
2	1	09	35		74	4.5	1	37	1	66		29		5 4		5 4
3		3 5	48		87	3 1	1	7 1	2	80		56		50	1	1 2
4	i	46	50		96	29	i	8 4	3	27		67		5 2	1	2 9
;	1	ა 6	49	1	08	3 1	1	98	3	33		77	-	56	1	37
6	1	68	44	1	24	35	2	13	3	5 6		8 9		65	ı	3 8
7	1	79	39	1	40	40	2	27	3	52	1	00		73	1	37
8	1	94	3.5	1	5 9	44	2	4.5	3	6 1	1	15		8 2	1	39
9	2	04	3 1	ı	73	48	2	57	3	38	1	25		90	1	3 4
1.0	2	18	2 6	1	92	5 4	2	75	3	59	1	3 9	1	00	1	39
4.1	2	26	20	2	0.6	59	2	8 5	3	47	1	46	1	8 0	1	3 5
1 2	2	32	14	2	17	6.5	2	92	3	3 4	1	5 2	ı	16	1	3 1
13	2	37	1 1	2	27	69	2	99	3	30	1	58	i	2 1	1	30
1.4	2	38	10	2	29	70	3	0 1	3	28	1	5 9	1	23	1	30

LAW ENGINEERING TESTING COMPANY TRIAXIAL SHEAR TEST

PROJECT NAME & NO. ARE W4-4519 DEGAUSSING RANGE BORING NUMBER IS 4E UD @ 5 5 FT DAMPLE IDENTIFICATION IS SOFT GRAY SLIGHTLY CLAYEY SAND

CONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAIN CONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

PROPERTY		NITIAL	CONSOLIDAT	TED
HEIGHT	=	4 260	4 251	INCHES
VOID RATIO	=	733	721	
AREA	=	3 190	3 176	SQ IN
FERCENT MOISTURE	=	25 12	26.61	PERCENT
WE'T DENSITY	=	122 11	124.40	PCF
DRY DENSITY	=	97 59	98 26	PCF
PERCENT SATURATION	=	92 89	100 00	PERCENT

NOTE - CONSOLIDATED PROPERTIES CALCULATED FROM MEASURED VOLUME CHANGE

OUTPUT DATA

READING	STRAIN	SHEAR	VOLUME	AOID	A
NUMBER		STRAIN	STRAIN	RATIO	FACTOR
	(IN/IN)		(00/00)		
1	000000	000000	0000	721	000
2	003294	003294	0000	7 2 i	1 020
3	009645	009645	0000	721	699
4	016233	016233	0000	7 2 1	493
5	029172	029172	0000	721	314
6	042346	042346	0000	7 2 1	155
,	061637	061637	0000	721	039
8	081163	081163	0000	721	- 049
9	100689	100689	0000	7 2 1	- 097
10	119745	119745	0000	721	- 136
1 1	146093	146093	0000	721	- 176
1.2	172207	172207	0000	721	- 205
1 3	198791	198791	0000	721	- 250

READING	S 1 G 1	₽₩₽	EFF	EFF	TOTAL	EFF	Q	P	Q/P
NUMBER	(KSF)	(KSF)	SICI	5163	STRESS	STRESS	(KSF)	(KSF)	
			(KSF)	(KSF)	RATIO	OITAR	CAMBRIDG	L PARI	METERS
1	4 3	0 0	43	4 3	1 00	1 00	00	4 3	. 0 0
2	66	23	43	20	1 5 2	2 i 2	2 2	28	8 1
3	79	2 5	5 4	18	1 83	2 97	3 6	3 0	1 19
4	90	23	67	20	2 08	3 31	47	3 6	1 31
5	1 05	19	8 5	2 4	2 4 2	3 5 7	6 1	44	1 38
6	1 23	1 2	1 11	3 1	2 8 5	3 60	80	5 7	1 39
7	1 47	04	1 43	3 9	3 40	3 65	1 04	74	1 4 1
8	1 72	- 06	1 78	50	3 98	3 60	1 29	92	1 39
9	1 9 1	- 14	2 0 6	58	4 43	3 57	1 48	1 07	1 38
1 0	2 10	- 23	2 33	66	4 86	3 53	1 67	1 22	1 37
1 1	2 36	- 34	2 70	77	5 46	3 50	1 93	1 41	1 36
. 2	2 6 4	- 45	3 09	8 8	6 10	3 4 9	2 20	1 62	1 36
1.3	2 67	- 56	3 24	9 9	6 19	3 26	2 24	1 74	1 29

B. Unconsolidated Undrained and Other Specified Tests Results

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LAW ENGINEERING TESTING COMPANY

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SOIL DATA SUMMARY

BORING	SAMPLE	SAMPLE	SOIL	UNIT WI	UNIT WEIGHT	% FINER NO 200	SPECIFIC	VOID	NATURAL	ATT	ATTERBERG LIMITS	RG	ADDITIONAL TESTS CONDUCTED
NO.	DEPTH (FT.)	TYPE	CLAS	Wet	Dry	Sieve	GRAVITY	RATIO	æ	L.L.	P.L	P.I.	
1-н	0-5	αn				94.5							
1-G	5-10	Ωħ								42	20	22	
1-F	10-15	UD		•		79.8							
1-E	15-20	αn	СН	٠,		98.2			88.0	91	35	26	
1-D	20-25	αn				97.5							
1-c	25-30	αn								79	31	48	
1-B	30-35	an				99.1							
2-H	0-5	αn				64.8							
2-G	5-10	αn								74	26	48	
2-F	10-15	αn				93.1							
2-E	15-20	QΩ	НЭ			99.0			74.5	77	32	45	
2-D	20-25	αn				98.7							
2-C	25-30	ΦN								94	36	58	
2-B	30-35	αn				8.8						_	

1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System NOTES:

Degaussing Range PROJECT NAME

W4-4519 PROJECT NUMBER

Norfolk, Virginia PROJECT LOCATION

LAW ENGINEERING TESTING COMPANY

STATES STATES SERVICE SERVICES

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SOIL DATA SUMMARY

GNIGOR	G AND E		SOIF	UNIT WEIGHT	EIGHT	% FINER	SPECIFIC	VOID	NATURAL	ATT	ATTERBERG	ig.	ADDITIONAL TESTS CONDUCTED
NO.	DEPTH (FT.)	TYPE	CLAS	Wet	Dry	SIEVE	GRAVITY	RATIO	5°	L.L.	P 1.	<u>-</u>	
3-F	0-5	αn				77.0							
3-E	5-10	an								32	22	91	
3-D	10-15	ΩD				57.5					_		
3-C	15-20	UD	CL			78.5			47.0	43	18	25	
3-B	20-25	αn				91.4							
3-A	25-30	an	СН			99.5				74	29	45	
4-F	0~5	αn		127.8	104.9	13.7	2.66	. 582	21.9				UU Triaxial
4-E	5-10	Фn		122.1	96.9		2.68	.726	26.0	15	Q.	1	UU Triaxial
4-D	10-15	αn				34.4						\dashv	
4-C	15-20	UD	SC	118.6	92.7	39.6	2.69	.81	27.9	28	19	6	UU Triaxial
4-B	20-25	αn		115.8	85.9	23.2	2.68	.947	34.8		1	1	UU Triaxial
4-A	25-30	αn	SM	126.9	104.1	15.7	2.68	.607	22.0	14	g.	-1	UU Triaxial
											_		
												1	

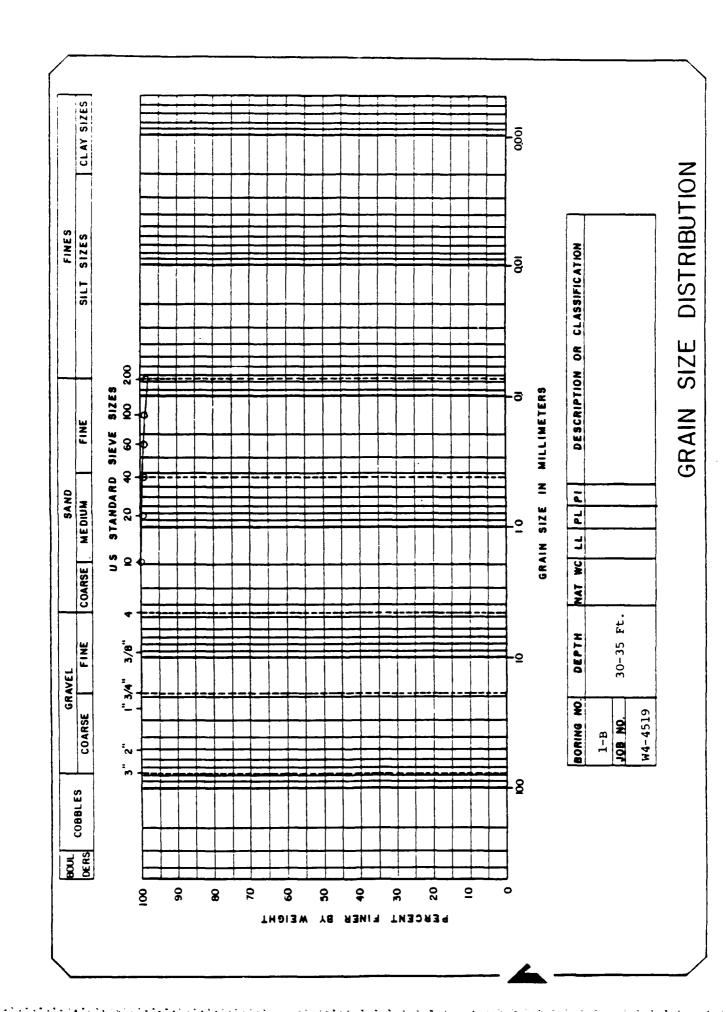
1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System NOTES:

Degaussing Range PROJECT NAME

PROJECT NUMBER

W4-4519

Norfolk, Virginia PROJECT LOCATION



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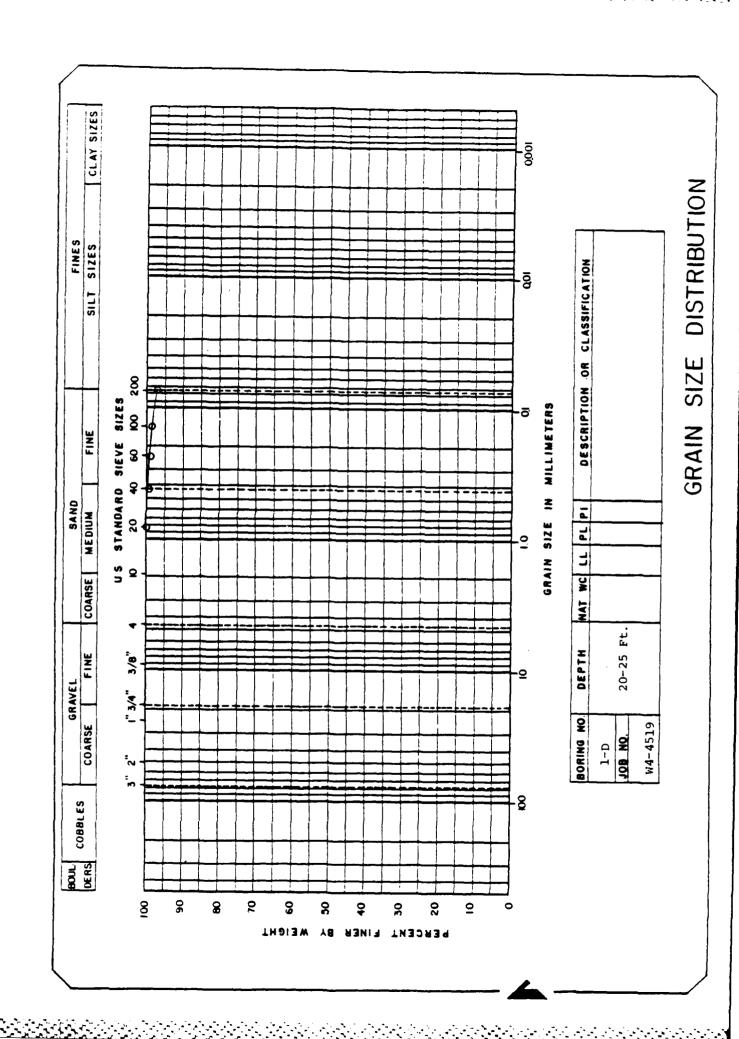
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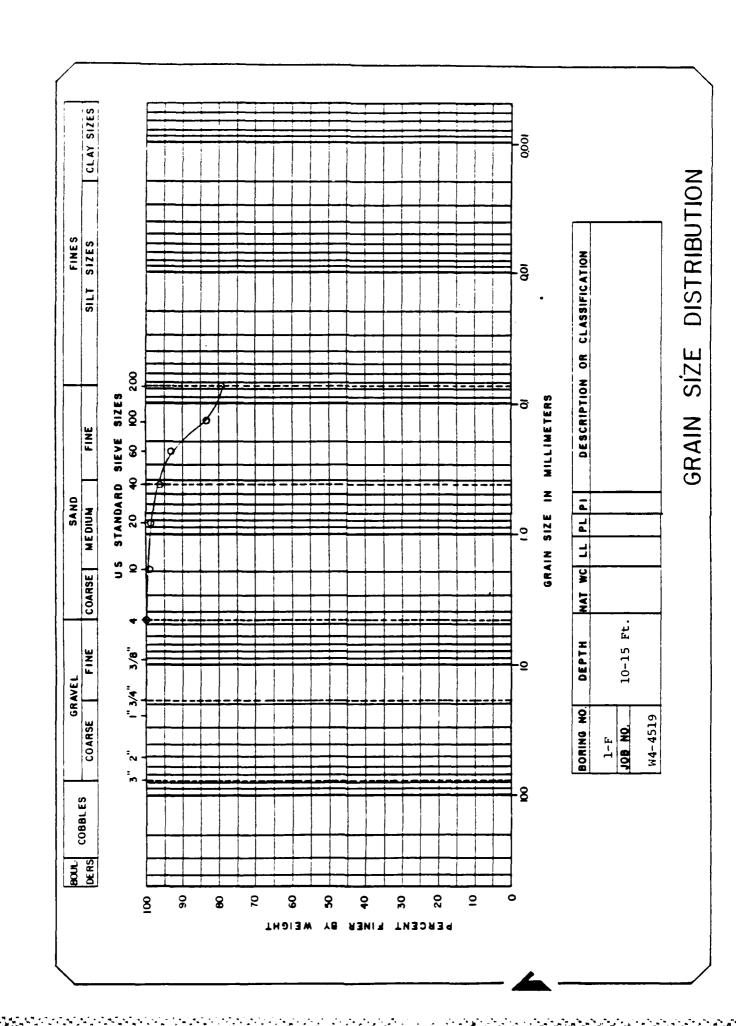


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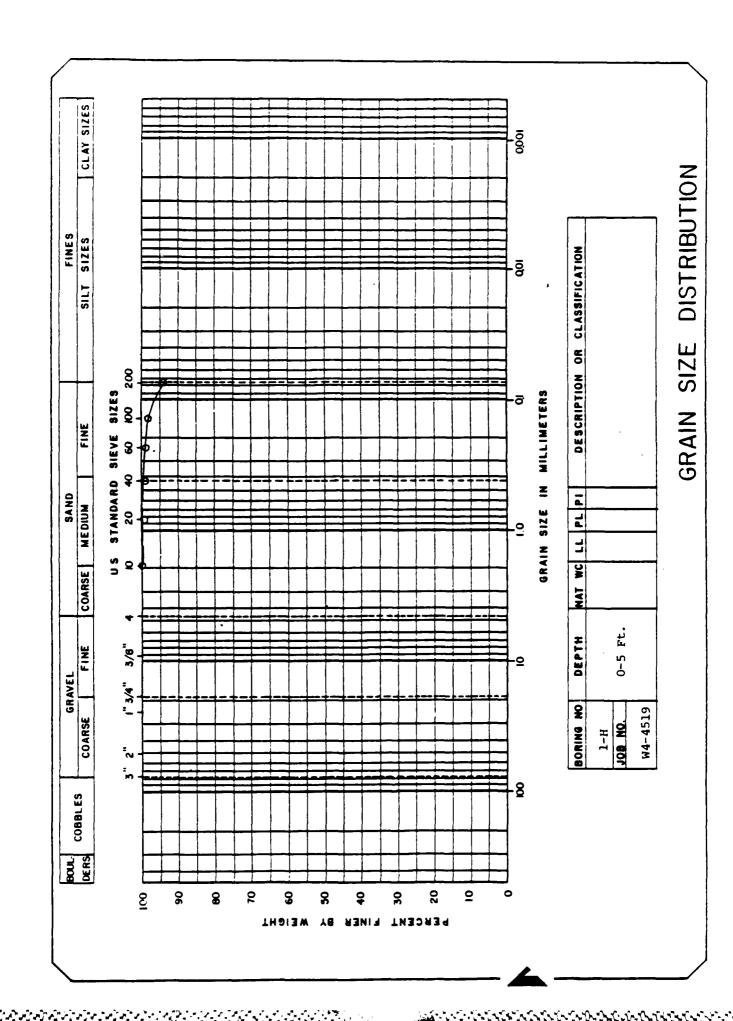
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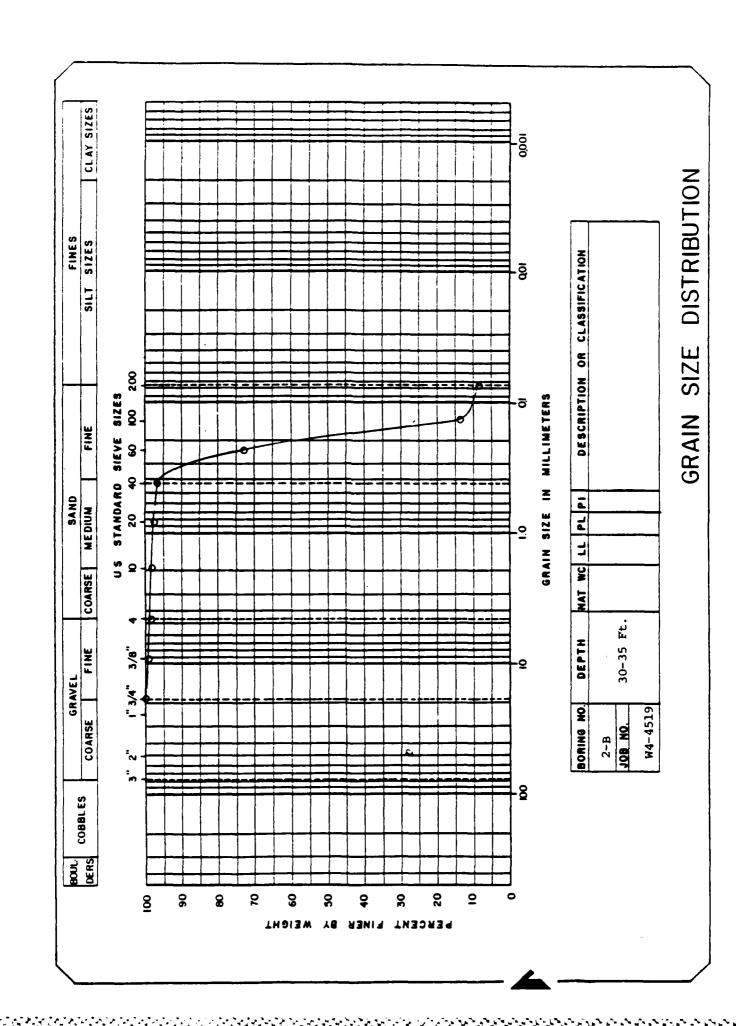


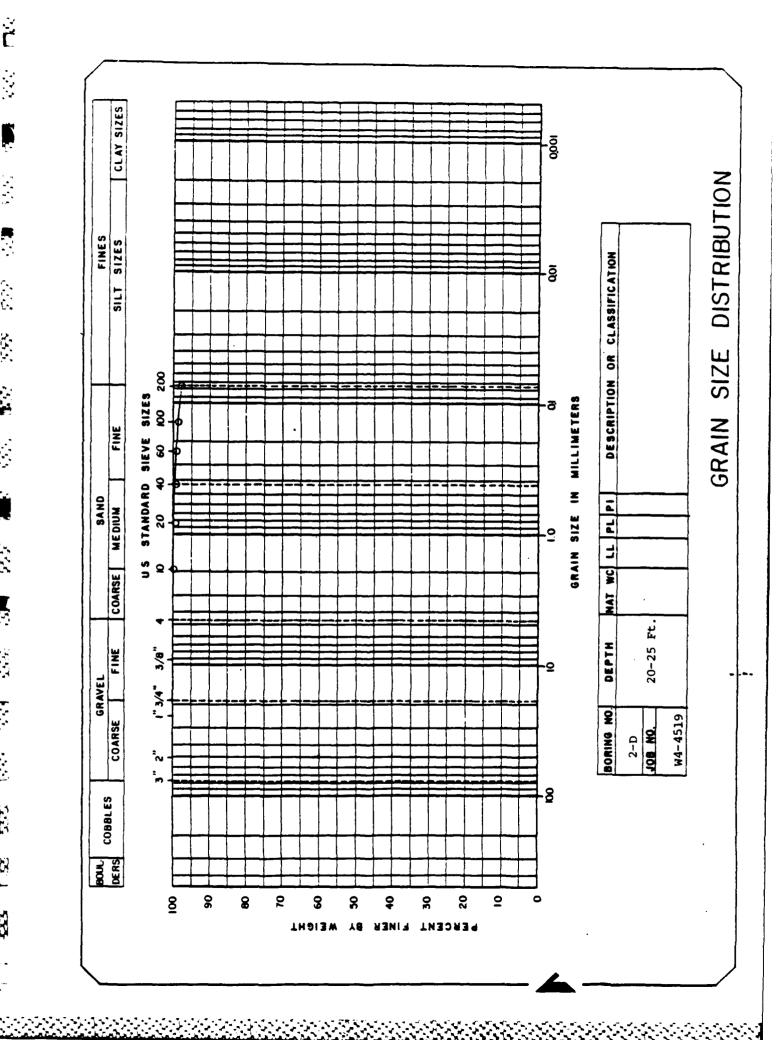
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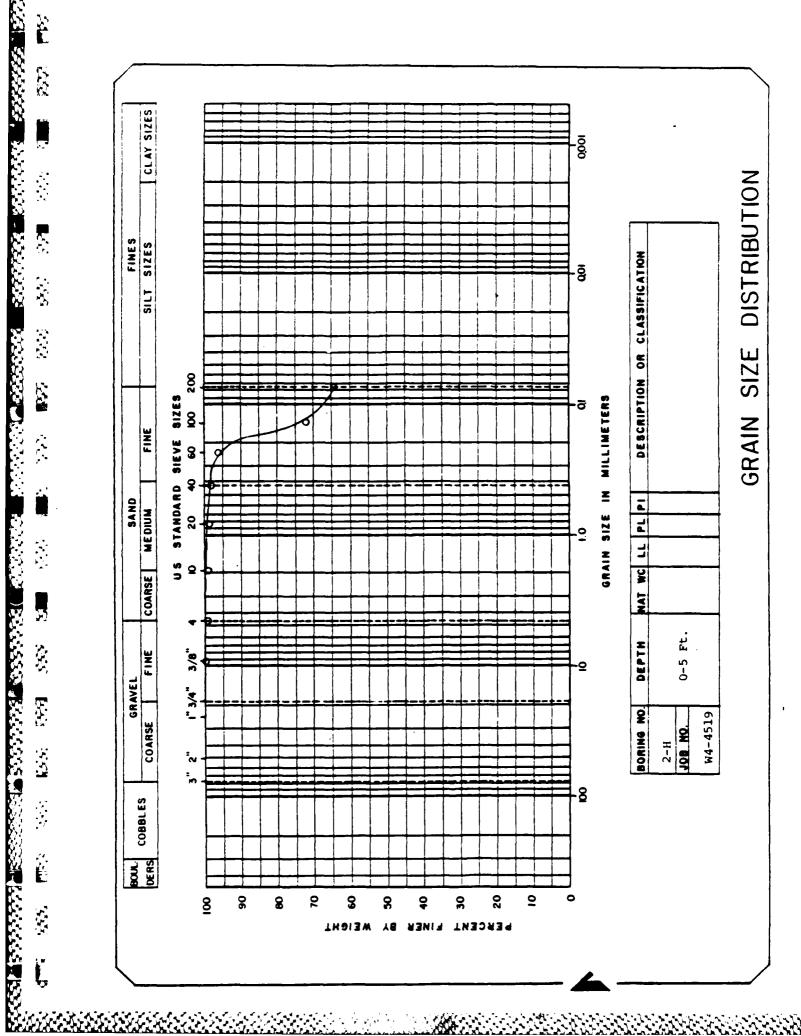
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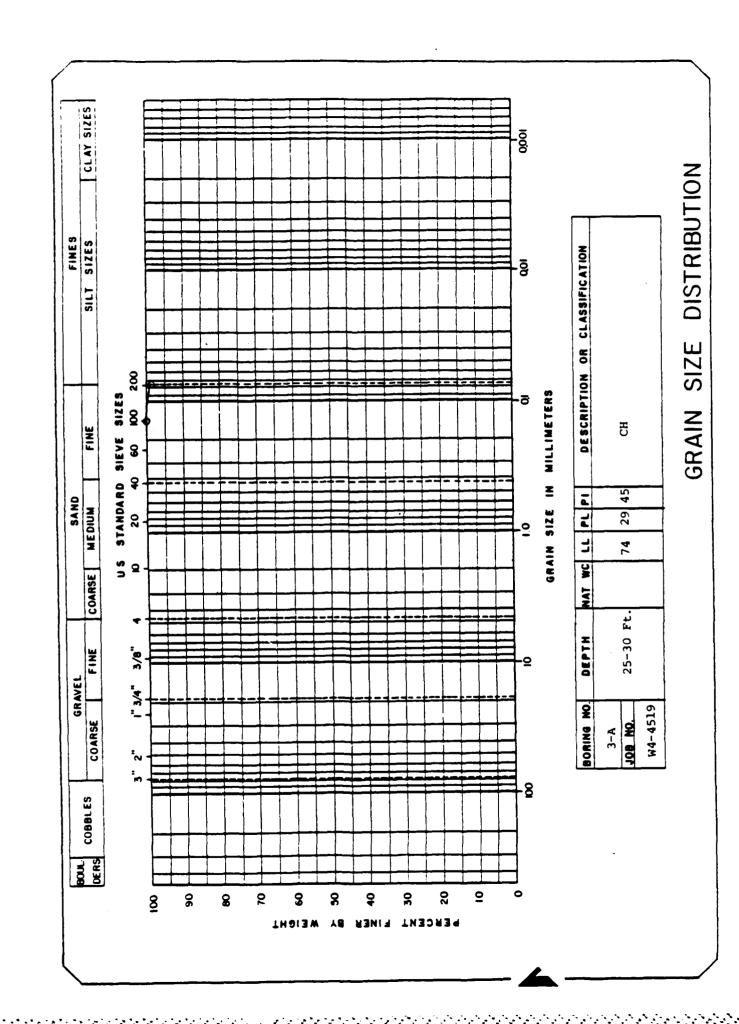
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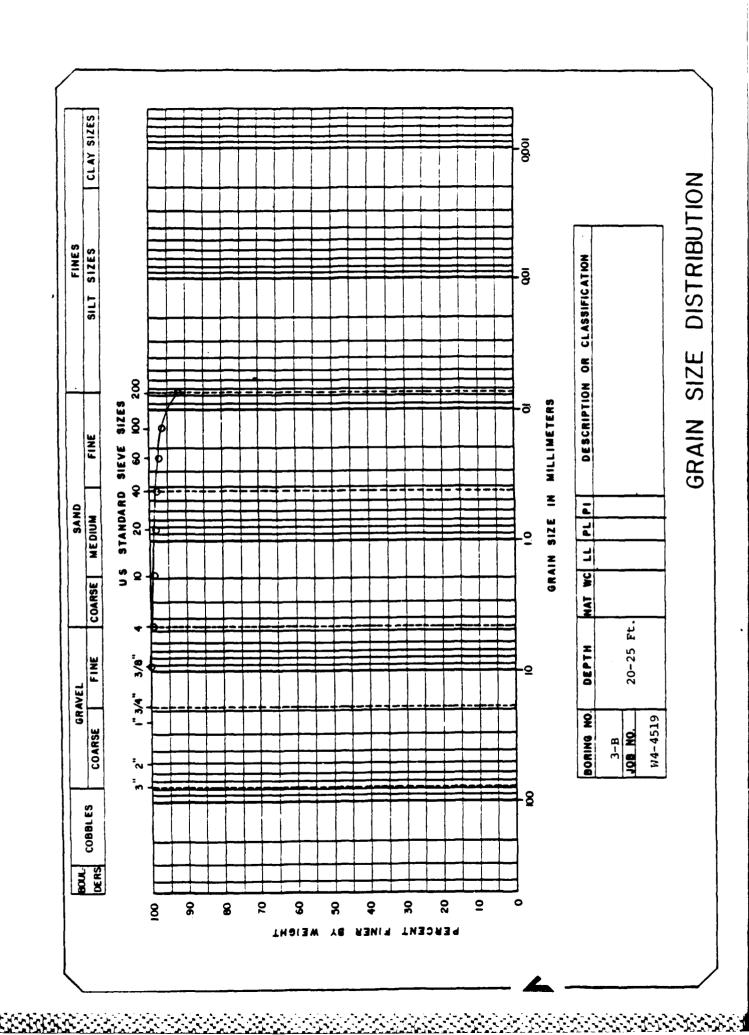
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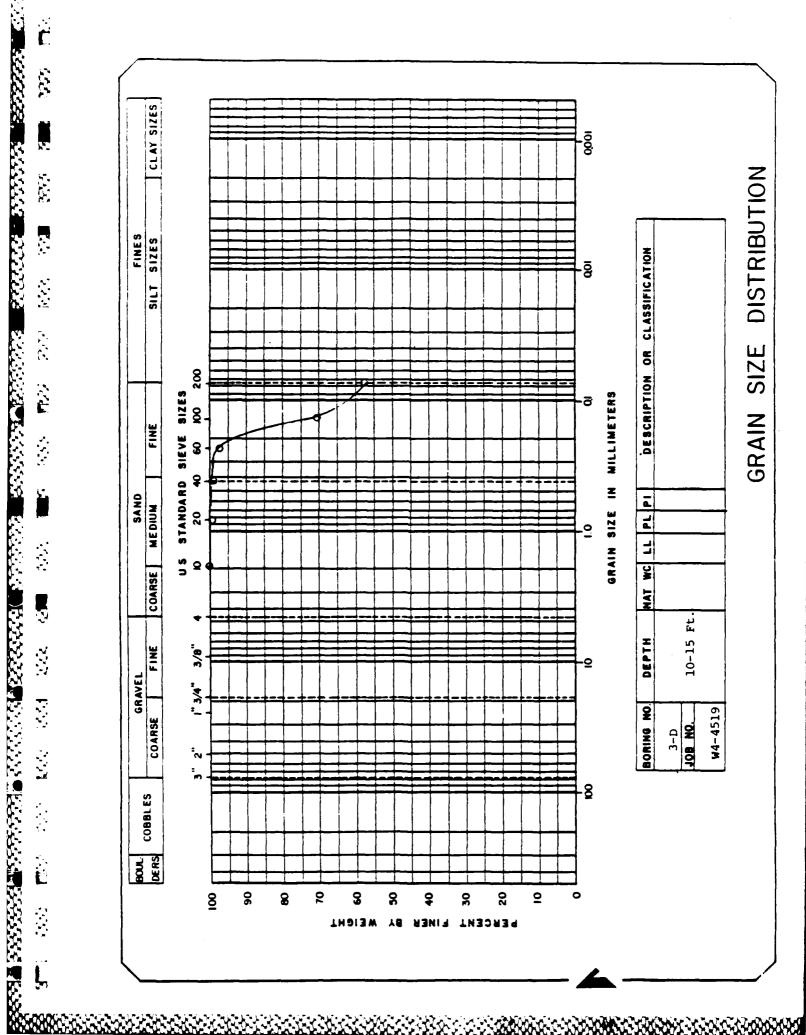
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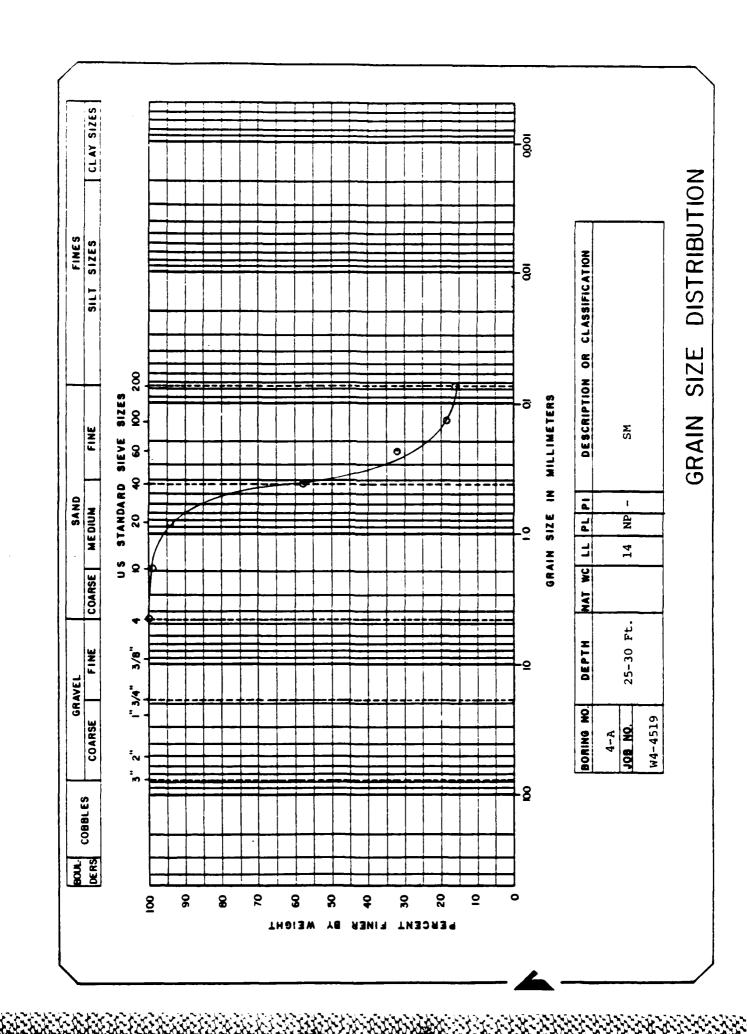
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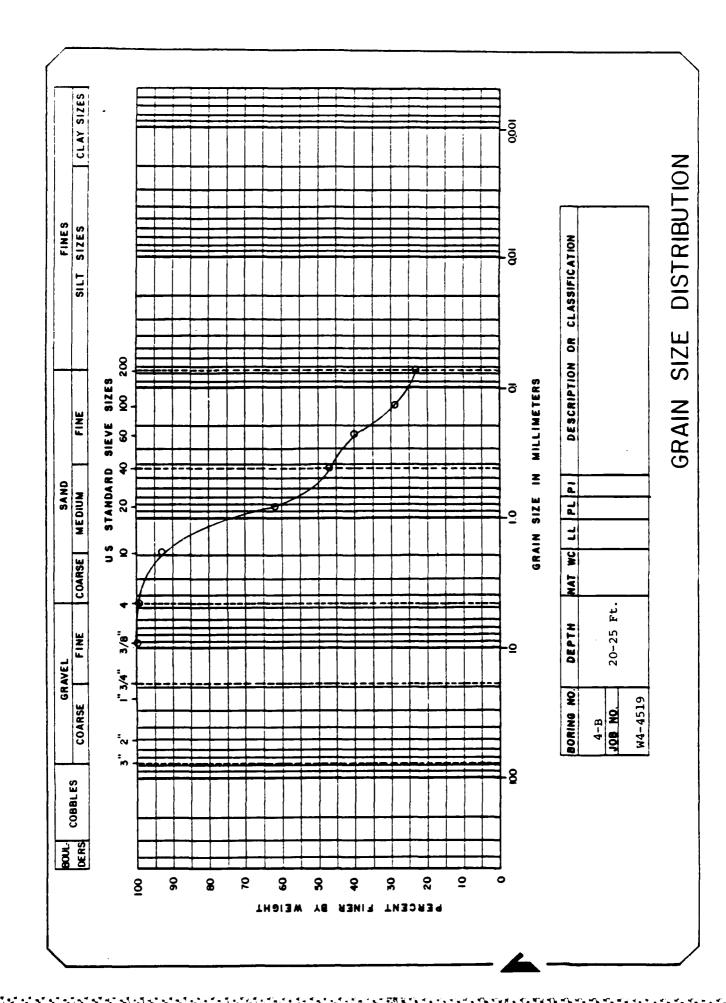
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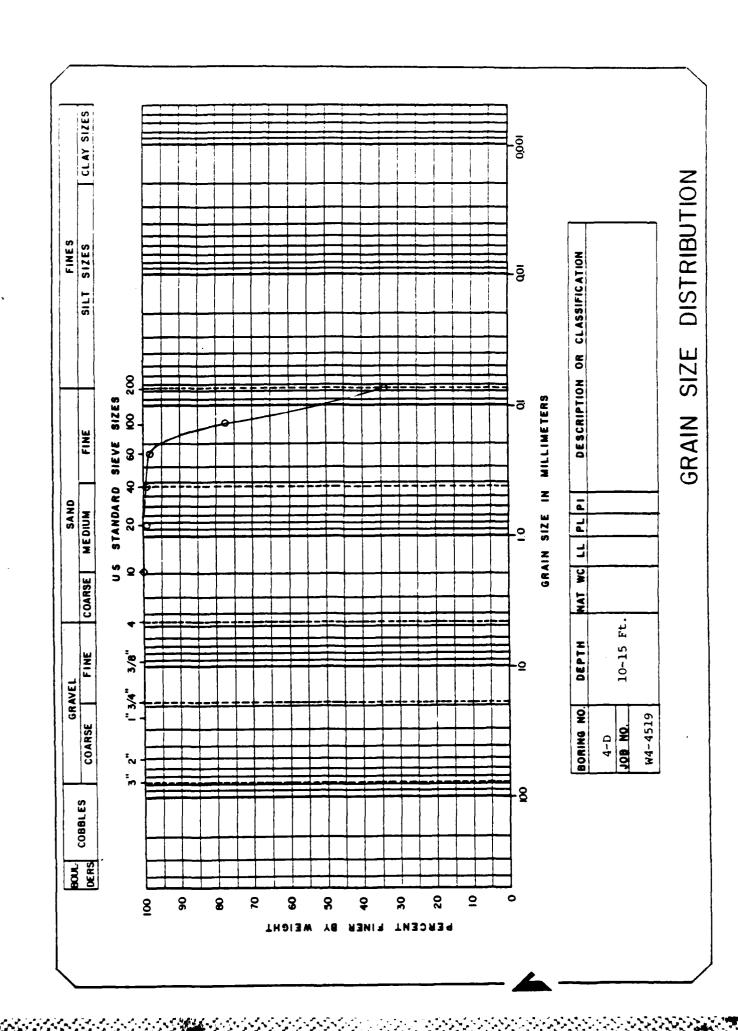
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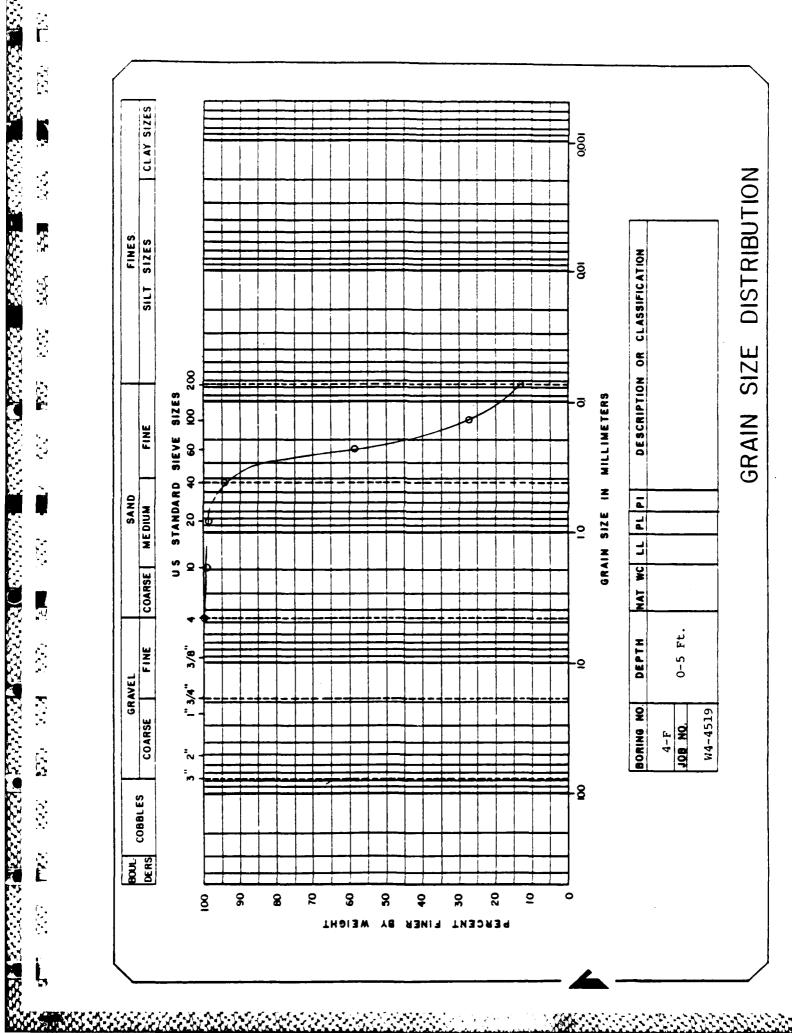
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LAW ENGINEERING TESTING COMPANY TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DECAUSSING RANGE BORING NUMBER IS 4F UD @ 4 FT SAMPLE IDENTIFICATION IS FIRM GRAY FINE-MEDIUM SAND, LITTLE FINES

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 10763 CALIBRATED 3 / 1984

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	P	R O	P	E	R	T	I	E	S		
SPECIFIC GRA	.v.:	ΓY			=		7	. (66		
LIQUID LIMIT					=				0		
PLASTIC LIMI	T				=				0		
INITIAL LENG	TH				=		;	3. '	93	INC	HES
OITAR QIOV					=			. 5	8 2		
INITIAL AREA					=		3	. 4	6 4	SQ.	IN.
MOISTURE CON	(TE	NT			=		2	١.	90	PER	CENT
WET DENSITY					=	: 1	2 '	7 .	8 7	PCF	
DRY DENSITY					=	: 1	0	4 . '	90	PCF	
PERCENT SATU	RA	rio	N		=	: 1	10	D .	03	PER	CENT
CELL PRESSUR	lΕ				=	:			23	KSF	

INPUT	DATA	очтр	UTDA	TA
DEF	RING	STRAIN V	STRESS T	STRESS
INCHES	DIV	IN/IN	KSF	KSF
700000	1.0	00000	000	. 230
710000	5 0	.002545	. 158	. 388
720000	6.5	. 005089	216	. 447
. 730000	8 0	.007634	. 275	. 505
740000	9.0	.010178	. 313	. 5 4 3
760000	11.0	015267	. 389	. 620
780000	13.0	020356	. 465	. 695
800000	14.5	. 0 2 5 4 4 5	. 5 2 0	. 751
850000	20.5	.038168	742	. 972
900000	25.5	.050891	919	1.150
980000	34.0	.071247	1.212	1.442
1 030000	38 0	. 083949	1.340	1.570
1 100000	43 5	.101781	1.509	1.740
1 150000	46.0	. 114504	1.575	1.806
1 240000	50.0	137405	1.671	1.902
1 330000	53 0	160305	1.726	1.957
1.420000	55.0	. 183206	1.744	1.974
1 500000	55.5	203562	1.716	1 947

LAW ENGINEERING TESTING COMPANY TRIAXIAL SHEAR TEST

PROJECT NAME & NO. ARE W4-4519 DEGAUSSING RANGE BURING NUMBER IS 4E UD @ 9 FT. SAMPLE 1DENT1FICATION IS FIRM TO LOOSE SILTY FINE-MEDIUM SAND

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 10763. CALIBRATED 3 / 1984

PROPERTIES SPECIFIC GRAVITY = 2.68 LIQUID LIMIT = 0 PLASTIC LIMIT = 0 INITIAL LENGTH = 3.99 INCHES VOID RATIO = .726 INITIAL AREA = 3.398 SQ. IN. MOISTURE CONTENT = 26.04 PERCENT WET DENSITY = 122.14 PCF DRY DENSITY = 96.91 PCF PERCENT SATURATION = 96.18 PERCENT CELL PRESSURE = .52 KSF

INPUT	DATA	оит	PUTD	АТА
DEF	RING			T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
.00000	2.0	.00000	. 0 0 0	518
.010000	5.0	.002506	. 121	. 639
.02000	6.0	.005013	160	. 679
040000	7.0	.010025	. 199	. 718
.060000	8.0	.015038	. 238	. 757
100000	10.0	.025063	314	833
150000	12.0	. 037594	388	. 906
200000	13.5	.050125	. 440	. 959
260000	15.0	. 065163	. 490	1.008
320000	16.5	. 080201	538	1.056
. 400000	18.5	100251	. 5 9 8	1.117
. 520000	21.0	130326	. 666	1.184
600000	22.0	. 150376	. 685	1.203
700000	23.0	.175439	698	1.216
800000	23.5	200501	. 693	1 211

LAW ENGINEERING TESTING COMPANY TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE BURING NUMBER IS 4C UD @ 16 FT. SAMPLE IDENTIFICATION IS LOUSE-VERY LOOSE GRAY FI-MED SAND, LITTLE FINES

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 1433. CALIBRATED 3 / 1984

PROPERTIES SPECIFIC GRAVITY 0 LIQUID LIMIT 0 PLASTIC LIMIT 3 92 INCHES INITIAL LENGTH VOID RATIO . 810 INITIAL AREA 3 194 SQ IN MOISTURE CONTENT 27 88 PERCENT WET DENSITY = 118.60 PCF 92 74 PCF DRY DENSITY PERCENT SATURATION = 92.60 PERCENT 92 KSF CELL PRESSURE

INPUT	DATA	ουτ	ם דט פ	ATA
DEF	RING	STRAIN	V.STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
- 239000	4.0	.00000	. 0 0 0	. 922
230000	6.5	. 002295	. 1 1 2	1.034
- 209000	7.5	. 007649	. 157	1.078
171000	9.0	.017338	. 2 2 2	1.143
055000	10.5	.046915	279	1.201
.075000	11.5	080061	. 311	1.233
200000	14.0	. 111933	400	1.322
. 330000	17.0	. 145079	501	1.423
450000	18.5	. 175676	. 539	1.460
540000	19 0	198623	. 5 4 2	1.464
410000	19 0	216471	. 530	1.451

LAW ENGINEERING FESTING COMPANY TRIAXIAL SHEAR TEST

PROJECT NAME & NO ARE W4-4519 DEGAUSSING RANGE BORING NUMBER IS 4B UD @ 21 FT SAMPLE IDENTIFICATION IS LOOSE GRAY FINE SAND, LITTLE SILT & CLAY

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 1433. CALIBRATED 3 / 1984

PROPERTIES SPECIFIC GRAVITY 2.68 LIQUID LIMIT 0 PLASTIC LIMIT 0 . 4.18 INCHES INITIAL LENGTH . 947 OITAR GIOV INITIAL AREA 3.115 SQ. IN. MOISTURE CONTENT 34.79 PERCENT WET DENSITY = 115.78 PCF DRY DENSITY 85.89 PCF 98.47 PERCENT PERCENT SATURATION 1.21 KSF CELL PRESSURE

INPUT	DATA	OUTP	U T D	ATA
DEF	RING	STRAIN V	STRESS	T.STRESS
INCHES	DIV	IN/IN	KSF	KSF
- 542000	6.0	. 0 0 0 0 0 0	. 0 0 0	1.210
529000	7.0	.003114	. 046	1.256
- 480000	8.5	_014850	. 114	1.323
- 406000	10.0	.032575	. 179	1.388
- 297000	11.5	.058683	. 239	1.449
- 234000	12.0	. 073772	. 257	1.466
163000	13.5	. 090778	. 315	1.525
- 088000	14.5	. 108743	. 350	1.560
128000	15.0	. 160479	349	1.559
253000	15.5	. 190419	. 355	1.565
332000	16.0	. 209341	365	1.575
471000	17.0	242635	385	1.595

LAW ENGINEERING TESTING COMPANY TRIAXIAL SHEAR TEST

PROJECT NAME & NO. ARE W4-4519 DEGAUSSING RANGE BORING NUMBER IS 4A UD @ 27 FT SAMPLE IDENTIFICATION IS LOOSE GRAY FI-MED SAND, SOME SILT & CLAY

UNCONSOLIDATED UNDRAINED COMPRESSION TEST WITH STRAINCONTROL

PROVING RING 1433 CALIBRATED 3 / 1984

	PR	O	P	E	R	T	I	Ε	S		
SPECIFIC GRA	VIT	Y			=	:	2		8 8		
LIQUID LIMIT	•				=	:			0		
PLASTIC LIMI	7				=	:			0		
INITIAL LENG	TH				=	;	4	1.2	2 1	INC	tES.
VOID RATIO					=			6 (7		
INITIAL AREA	١.				=	;	3.	2 1	1 1	SQ.	IN.
MOISTURE CON	ITEN'	Г			=		2 1	9	8 9	PER	CENT
WET DENSITY						: 1	2 6		93	PCF	
DRY DENSITY					=	: 1	0 4	l . (3 6	PCF	
PERCENT SATU	JRAT	I ON	Į.		=	:	97	'. () 4	PER	ENT
CELL PRESSUR	3 E				=	:	1		5 6	KSF	

[c	LIGOID LIMIT	= 0
€ 33	PLASTIC LIMIT	= 0
.53.4 	INITIAL LENGTH	= 4 21 INCHES
P (8)		_ 407
	VOID RATIO	= .607
	INITIAL AREA	= 3.211 SQ. IN.
327.X	MOISTURE CONTENT	= 21.98 PERCENT
	WET DENSITY	= 126.93 PCF
Į.		
	DRY DENSITY	= 104.06 PCF
23.4 13.4	PERCENT SATURATION	= 97.04 PERCENT
	CELL PRESSURE	= 1.56 KSF
[1 -		
72		
W .70	INPUT DATA	OUTPUT DATA
.	DEF RING	STRAIN V.STRESS T.STRESS
	INCHES DIV	IN/IN KSF KSF
l K		
	- 593000 8.0	.000000 .000 1.555
	5 1 6 0 0 0 1 0 . 5	.018307 110 1.665
	450000 15.5	.033999 .325 1.880
7. 7.		
. ,	- 410000 18.0	
ે કે	- 350000 22.0	.057775 .592 2.147
	- 300000 25.5	.069662 .730 2.285
15 15	- 200000 33.0	.093438 1.016 2.572
l E		
_	050000 40.5	.129101 1.269 2.824
	200000 41 0	188540 1 201 - 2.756
0 X	300000 41.5	.212316 1.183 2.739
D	400000 41.0	. 236091 1 . 130 2 . 686
l (2	. 400000 41.0	. 2000/1 1:100 2:000
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APPENDIX A

ENTRANCE REACH CHANNEL MODIFICATION

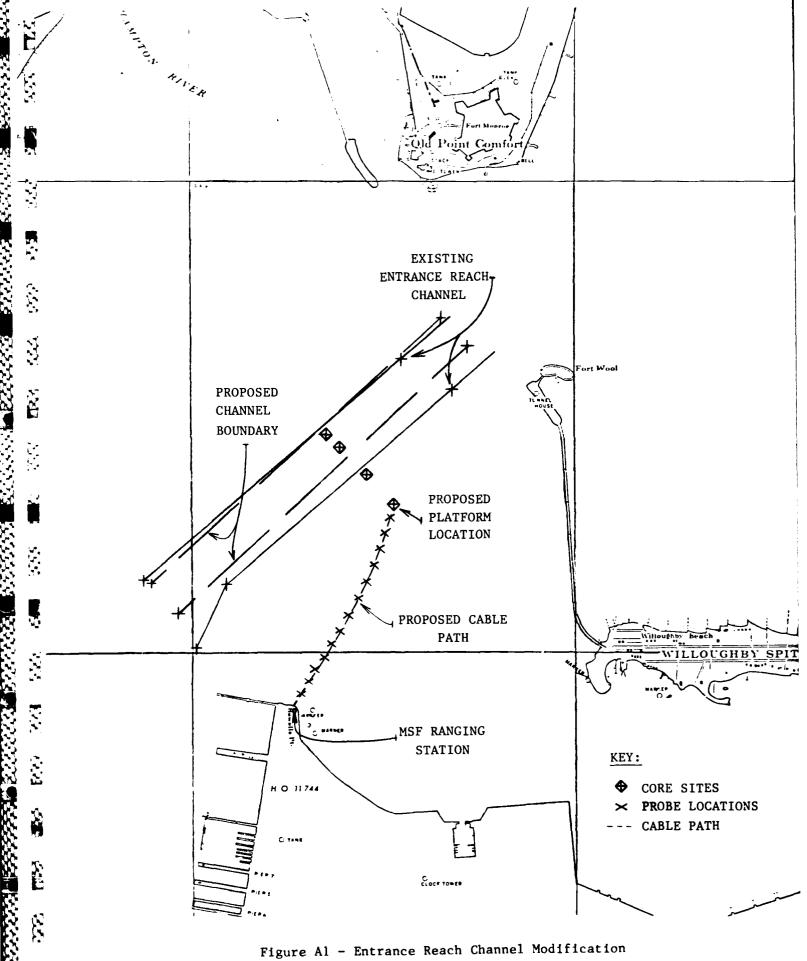
Part of the planned future maintenance of the Norfolk Harbor areas includes the deepening of several major channels. The Corps of Engineers, Norfolk District, plans to modify the Entrance Reach Channel by an approximate two degree rotation to the north. Thus, it was necessary to incorporate planned modifications to the channel into this survey. The Corps of Engineers provided CHESDIV with coordinates for two points which define the altered north—west channel boundary. The geodetic positions in Latitude and Longitude and the Lambert Grid State Plane (South Virginia) coordinates in feet are given below.

Lat Long	 59'25.76" 18'41.77"	 246665 2639100	Northing Easting
Lat Long	58'17.87" 20'12.72"		Northing Easting

The Corps also plans to reduce the width of the channel to 1000 feet from the existing 1500 foot wide waterway. Figure Al shows the existing channel as marked on USGS chart 12245 as well as the modified channel as defined by the given coordinates.

The core location coordinates were derived from the given channel boundary coordinates. The bearing of the new channel was found to be 45° 44' 36.73". A line from the Sewell's Spit proposed platform location was drawn perpendicular to the channel centerline. The 1st and 2nd core sites were located on this line 250' on either side of the channel centerline. The 3rd core was located approximately 925' from the centerline along the coring line toward Sewell's Spit. The 4th core site was located at the 5' water mark on Sewell's Spit. The geodetic positions in Latitude and Longitude and the Lambert Grid State Plane (South Virginia) coordinates in feet are given below:

CORE	#				Design	Coordinates		Located
1		Lat	360	58'	55.51"	243538.47	Northing	243539
		Long	76 ⁰	19'	17.78"	2636249.49	Easting	2636250
2		Lat	360	58'	51.89"	243180.36	Northing	243181
		Long	76°	19'	13.59"	2636598.42	Easting	2636600
3		Lat	36°	58'	45.19"	242517.86	Northing	242518
		Long	760	19'	05.82"	2637243.96	Easting	2637240
4		Lat	360	58'	37.50"	241756.76	Northing	241757
		Long	760	18'	56.90"	2637985.55	Easting	2637990



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